Facilitation for Diversity, Equity, and Inclusion through Design Thinking

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WIP: Facilitation for Diversity, Equity, and Inclusion through Design Thinking

Abstract

This paper explores how facilitating design thinking (DT) can transform engineering cultures for greater diversity, equity, and inclusion (DEI). We aim to understand better how facilitators apply DT to directly discuss options for DEI in particular engineering cultures, and to provide guidelines for developing facilitation expertise for DEI. Qualitative causal mapping is conducted to visualize how facilitators draw out participants' understandings and explanations of marginalization and inclusion by attending to design session participants' own expressions of causality and hopes for the future.

Introduction

Diversity, equity, and inclusion (DEI) are at the forefront of efforts by institutions of higher education to create learning spaces in which full participation of all members is encouraged and appreciated. Whereas diversity typically means representation of different identity groups classified by race/ethnicity, gender, sexual orientation, ability, nationality of origin, and other categories, equity and inclusion are more complex conceptually and operationally. Equity is attuned to what is fair in treatment and outcomes, noting differences among participants, as distinguished from equality, where all conditions and consequences are rendered as the same. Inclusion involves a sense of belongingness, with sincere considerations of how different backgrounds and ways of thinking, being, and valuing can affect organizational practices, interactions, procedures, and policy. In deriving insights and interventions to achieve the promise and implementation of DEI efforts, there are some generalizable interventions like training sessions [1], but how such training is constructed and accomplished is less known. Moreover, what works in one location is not necessarily effective in another, nor is any single intervention sufficient for complex issues such as DEI. Therefore, processes that generate locale-specific programs for specific users are essential. These processes can be constructed using Design Thinking (DT). Specifically, this study examines how to facilitate Design Thinking (DT) sessions aimed at designing DEI efforts and to offer guidelines for developing facilitation expertise.

Because design is a central and distinguishing activity of, and core criterion for evaluating, engineering [2], the use of DT to address complex challenges in engineering education, organizational development, and change efforts has become increasingly valued. According to the *Harvard Business Review*, DT is a powerful problem-solving process in areas such as global health care and infectious disease prevention, employee engagement, strategic planning, and team relationships [3, 4, 5, 6, 7, 8]. Kolko [9] argues that "There's a shift under way in large organizations, one that puts design much closer to the center of the enterprise. But the shift isn't about aesthetics. It's about applying the principles of design to the way people work" (p. 1). DT and human-centered design work because of empathy, learning to embrace failure while prototyping many different ideas, and sharing and co-designing with clients, project partners, and co-workers [10, 11].

Although much as been written about the phases and exercises involved in DT [12] and related human-, empathic-, and culture-centered design models [13], less is known about how these sessions are facilitated [14, 15, 16]. In considering how sessions are facilitated, we pay attention to the material aspects of design, meaning the space, to facilitators, and the goals for each design session. Space is the virtual and/or physical place with artifacts, lighting, graphical user interfaces, and site ownership. Facilitators are the people, figures, and prototypes used to direct action. Facilitators assist groups or teams in accomplishing their tasks and relational goals while avoiding or lessening the effects of dysfunctional interactions. The figures and prototypes are whiteboard drawings, documents, graphs, media, 3D configurations of proposed solutions, and so on, whose affordances—characteristics that interact with facilitators and users' interests—enable action. Finally, the organizing goals are outlined by DT models (inspiration, ideation, implementation, [12], with the specific aims in our case being DEI.

Although facilitation might appear easy insofar as it simply helps groups direct their action toward goals, the process is complex and requires attention to many material and discursive aspects. The materialities include sites, bodies, and artifacts [17]. The discursive features are the talk in interactions (discourse) and the broader cultural formations or societal understandings that make such talk and interactions (Discourse) sensible in each setting and culture [18]. For our purposes, the Discourses of higher education, DEI, gender, race, nationality, engineering and subdisciplines, campus culture, and related understandings are both background to our DT sessions and drive conversations or discourse within the sessions and in the broader College of Engineering environment.

Yet, little scholarship has delved into how DT facilitation happens, especially in sensitive areas such as creating inclusion as an ethical requirement for engineering cultures. In this paper, we explore how the facilitation of DT can transform engineering cultures for greater DEI. Our aims are: to better understand how facilitators work with DT participants in particular spaces and engineering cultures regarding sensitive ethical issues like DEI; and to provide guidelines for developing facilitation expertise for DEI in DT sessions.

To accomplish these aims, we (1) provide background on our four-year NSF-funded project to use DT for DEI in the professional formation of engineers; and (2) detail how DT facilitation attends to the everyday communicative actions that can foster long-term inclusionary engineering cultures. We utilize qualitative causalities because they are "*expressing and constituting* the rich and varied experiences and (ir)rationalities that move people toward insights about *the specific factors and elements* that inform certain events or experiences that take place their lives, *when* the events or experiences take place, and *how*—through what mechanisms, processes, or sequences of events in interaction—the events or experiences unfold" [19, p. 244]. We show how facilitation brought one group to deep explanations and understanding of how majority and underrepresented group members in a College of Engineering felt exclusion and inclusion and what visions they could produce from their collective sensemaking. Qualitative causal mapping provides DT facilitators with a tool to listen for, plan, and mark passages to draw out explicit and implicit linkages that might not be conscious or intentional. In the case of the DT facilitator in our study, he displayed strategies to encourage causal expressions such as pulling data from past sessions and encouraging reflection, digging below the surface meanings of talk to underlying feeling (longing for inclusion, confusion with why people do not act in particular

ways), and expressions of curiosity). The DT session moves from visualizations of "perhaps" or possibilities and invitations to engage to closing visualizations that "put things together" for how DEI can be done.

Literature Review

DT for DEI in the Professional Formation of Engineers

In our NSF-funded project, we assumed that novice engineers are better prepared for their careers if they have real-world engineering team experiences, see DEI as critical to their work rather than an add-on, and learn how to integrate the socio-technical aspects of engineering design [20]. These assumptions are based on decades of reports advocating for interventions to accomplish these needs. We also assumed that these issues are intertwined "wicked problems," or deeply embedded contradictions and seemingly intractable problems, that require DT for sustainable transformation [21]. As wicked problems, solutions require adjustments over time and often reveal other considerations that must be embedded in design processes. Making wicked problems visible, exploring why such contradictions exist, and assisting groups in imagining and implementing potential solutions require skilled guidance. Yet, little scholarship has delved into how DT facilitation happens, especially in sensitive areas such as creating inclusion as an ethical requirement for engineering cultures.

In our project, we focused on the three DT phases—Inspiration, Ideation, and Implementation--in both the Schools of Electrical and Computer Engineering (ECE) and Biomedical Engineering (BME). Our approach sought to study and accommodate locale-specific interests of broad stakeholders (i.e., faculty, staff, administrators, and undergraduate and graduate students). In Year 2 (Ideation), we continued multimethodological analyses and focused on face-to-face co-design sessions *with* stakeholders to develop prototypical solutions to DEI concerns in ECE and BME. In Year 3 (Implementation), we encouraged prototypes to test or implement designs. Some of these prototypes have now been institutionalized in schools and undergo periodic assessment.

Facilitation

We draw upon scholarship describing what facilitators do, or how facilitation is accomplished, in various groups. The few studies that can be reviewed for these findings focus on different aspects of the facilitators' behaviors, styles, linguistic expressions, and understandings of what DT is and how to navigate DT goals.

For example, Franco and Nielsen [14] used conversation analysis to examine four videotaped sessions held with management and development teams to explore the craft of facilitation in workshops. The researchers moved back in forth between transcripts and videorecordings to note where and how facilitators used formulations. In formulations, prior talk can be reintroduced to achieve confirmation or to invite others to negotiate what is being discussed. Formulations do this by pulling out the general meanings and implications of talk. In Franco and Nielsen's cases, facilitators encouraged reflection, directed attention, and helped the group construct action plans. Facilitators utilized conversational skills to assist group members in their collective aims.

Although Franco and Nielsen [14] described what facilitators accomplished through their talk, Papamichail et al. [22] noted that "it is not always straightforward what the role of a facilitator should be (e.g., mediator, arbitrator or trouble-shooter) or what the expectations of the workshop participants are" (p. 623). To uncover what facilitators should do and how they should accomplish their role, Papamichail et al. gathered observational data and interviews to determine how facilitators use different decision-making software tools in problem-solving sessions to achieve action plans around a hypothetical scenario. They found that the facilitator's style (e.g., coercive or empathic) and approach (e.g., main assumptions and questions) might have impacted the outputs. However, the extent to which such findings might be generalizable was inconclusive.

Rather than tools and decision-making software programs like Papamichail et al. [22], Henriksen et al. [15] examined one-day collaborative problem-solving workshops with a meeting for debriefing among facilitators after the event. Through abductive thematic analyses, they explored how facilitators use a repertoire of roles to draw out participant contributions and reveal problem structuring, biases, and interests (amidst DT tensions in roles and practices). They found that facilitators must navigate and negotiate essential tensions or contradictions in four areas: the design process, design products, group dynamics, and the discussion flow. They concluded that "given increased popular application of design, more scholarly attention is needed to guide the roles and practices for the facilitators of design thinking processes" (p. 6).

Finally, Mosley et al. [23] and Starostka et al. [16] used case studies to understand facilitation. Mosley et al. developed two informal immersive learning experience case studies to show how expertise, context, and group membership can challenge facilitators. In comparing the two cases, they found "that not only does the expertise level of facilitators impact the learning experiences of non-design students, so does the complexity of the problem. The problem being addressed needs to fit the expertise and design thinking level of the participants in the workshop" as well as the expertise of the facilitator (p. 186). Starostka et al. created explorative case studies to analyze how facilitators understand and apply DT to innovation projects. They developed a taxonomy of DT facilitation in which different interpretations of what DT is seemed to affect where facilitators saw their roles or foci during sessions. These interpretations ranged along continua about DT as tools vs mindsets, DT foci as solutions vs problems, DT processes as planned vs emergent, and DT leadership as individual vs shared. They noted that facilitators' approaches can change during sessions.

In summary, the limited scholarship on facilitation offers insight into how different kinds of groups are guided and/or led and for what purposes. These studies range from conversational analytic (micro) investigations on how facilitators enact distinct sets of formulations to expedite action and encourage sensemaking [14] to preliminary frameworks for DT education with non-design and design students and for DT facilitators' selection of strategies and stances [23, 16]. Finally, although not aimed at facilitation per se, Kossek et al. [1] incorporated a table with pragmatic implications to outline how facilitators could attend to participant reactions and their own reflections in their efforts to adapt their microaggression ally training sessions for greater DEI. Kossek et al. [1] encouraged trainers' and facilitators' adaptation and continuous improvement of workshop content. They also advocated for facilitators' preparation "to learn

how to balance content breadth and depth as well as time for 'telling' versus 'engaging' learners" (p. 21).

Summary

Together, these studies display the distinctions and complexities involved in facilitating any group process. In our DT sessions, we wanted to understand and explain how facilitators drew out participants' understandings and explanations of marginalization and inclusion by attending the design session participants' own expressions of causality and hopes for the future. We used qualitative causal mapping of one facilitator's talk and interactions during one DT session on DEI to address this research issue. Qualitative causal analysis is useful "because it is a tool scholars can wield to map logics and people's responses to events as well as create visualizations of what may happen next: Emotions are shown; linguistic choices are depicted; and interactions within, between, and among human and non-human agents can be revealed" [19, p. 243]. We asked (RQ): How can qualitative causal mapping visualize facilitators' ways of moving from explicit and implicit causes to effects?

Method

Participants and Context

The four facilitators were all white, middle-class, cis-gendered, able-bodied university members with different affiliations (ECE, BME, Communication, Engineering Education). All had worked toward DEI in their professional association and/or administrative positions, teaching, advising of multidisciplinary design teams, student services and advising or mentoring, and service/engagement.

DT session participants were undergraduate and graduate students, staff members, student advisors, and professors affiliated with ECE who volunteered to attend and engage with others in one or more of the 6 ECE design sessions. In ECE, 22 participants attended the six sessions throughout the semester; however, for the fourth session, there were 16 participants in attendance. None were paid for their participation. We did not gather demographic data on DT session participants.

In the DT session selected for analysis, participants included the four co-authors/facilitators (2 male; 2 female; all white; graduate students and professors; ranging in age from mid-20s to over 50 years) and 16 participants of similar ages to the co-authors and different genders, races/ethnicities, and job types given their clothing which ranged from sweatshirts-headphone-handwritten name tags to professional-appearing shirts and sweaters with official university badges.

In terms of context, the session room has round and rectangular tables with moveable seats. The room appears open because the walls around the room are clear glass and can open to allow people in and out—like sliding glass doors—and with a corridor outside of the room. The room was located on a below-ground level floor of the ECE building. More broadly, the School of ECE is very large, and has the largest number of undergraduate students in a major at the

midwestern U.S. public institution of higher education. Faculty members of different ranks, 2 staff members, and a few professional advisors and administrators participated in sessions when their duties permitted.

Procedures

As background, we organized 6 DT sessions in each School of ECE and BME for a total of 12 sessions. Our DT sessions ranged from 90 minutes to two hours. One or more of the authors facilitated the 12 ECE and BME sessions. We obtained consent of participants to video record. We selected one ECE session (RFE Design Sessions/ECE/DS4 3.22.18 / 105_0211) for analysis for the following reasons: (a) all co-authors were present even though there was one primary facilitator; (b) this session pulled from the earlier survey and other data and findings about the make-up of an engineer, especially an ECE professional engineer in our NSF project's year 1 (inspiration) to brainstorming and discussions about specifications and potential prototypes (year 2, ideation) to act on the cusp of implementation.

As a transition in the DT work, session 4 had three goals: to revisit the design challenges from Session 3, to identify underlying issues within Session 3 design challenges, and to begin prototyping design solutions. We articulated our design challenges (see Table 1) and wrote them onto the whiteboard to help orient participants to the session work.

Table 1: Session 4 Design Challenges

1. How can we as a school work with students who are "under-prepared"? (unspoken cultural expectations + academic preparation)
2. How can we increase buy-in among ECE faculty?
3. How can we get students actively involved with each other in a lecture setting?
4. How can we build connections/bridges between/among students?
5. How can we get faculty, graduate students, and undergrads to see empathy, diversity, and inclusion as part of their day jobs?

This ECE Session 4 invoked Discourses of DEI, university and school missions, student survival and success, community, belongingness, time, "day jobs" (i.e., work for which one is responsible and has priority over other activities), among other Discourses to prove into the underlying assumptions that would and did drive feasible and ECE-specific deliverables in the implementation phase. Moreover, these discussions and the implementations directly led to institutionalizing an ongoing project to advance inclusion in ECE.

Data Analysis

After reviewing the videotaped sessions and selecting one ECE session (#4), we transcribed the 33.5-minute session into 11 single-spaced pages. We either inferred participant status (e.g., student, alum, staff, professor, from comments participants made or described the individual by visible characteristics, such as "male participant 1, professor" for a man who spoke about his students and classes he taught or "male participant 2, student" for someone who had a beard.

When participants mentioned names, we deleted these names and inserted pseudonyms into the transcript. We also noted participant gestures, others' response to speakers (eye contact directed toward speakers, laughter, brief interjections of agreement like "yea"), and position in the design session room with other participants, walls, the facilitator, and the whiteboard on which the design challenges for DT session 4 for ECE were noted.

To analyze our session 4, we utilize qualitative causal analyses in which explicit and implicit linguistic markers (e.g., "because", "then") within interactional episodes reveal how facilitators can encourage and discourage inclusion [19]. In qualitative causal analysis, researchers map the logics—how people come to know and engage in worldmaking, become, value, and/or enact plausible, purposeful action—without assuming that such maps are predictive and deterministic. The maps visually represent "how people express their reasoning during and/or after particular circumstances and outcomes of action. … the analyses are of people's *expressions* of their reasoning and such analyses are designed to identify the discursive formations individuals employ to engage in sensemaking about events" (pp. 243-244).

To do the mapping, we focused on what was linguistically sequential in our data. We examined linguistic markers, identified sequential speakers and content, looked for stories based off previous interactions, and noted how the conversation in the DT session unfolded. In these ways we look at the session's content and how the interactions took place (semantic and linguistic linkages). We looked for explicit or verbalized markers of causality embedded in the talk and interactions: if-then, because, so, as, then, and unless-then [19; see also 24, 25]. We also looked for implicit reasoning that connected Discourses with talk, such as DEI was peripheral to engineering or not prioritized, unless participants had slack time to engage in nice-to-know rather than need-to-know activities, that is, DEI→Not Priority. The causal structure revealed: Success (Successful Student)→ Time and Energy to Do Extracurricular, Fun, and Non-Essential but Meaningful Activities, whereas the explicit connections were Unsuccessful/Unprepared (Student)→Survival Mode (i.e., time and energy to only do what is needed to pass classes, all action is geared toward passing classes).

Given our aims for this paper, we attended to the role of the facilitator in these discussions. We drew upon scholarship describing how facilitators use a repertoire of styles to draw out participant contributions and reveal problem structuring, biases, and interests amidst DT tensions in roles and practices [15, 22]. We expected facilitators to engage with participants using formulations to expedite action and encourage sensemaking [14] using their DT expertise and considerations of issue complexities and participant experience [23, 16]. We attended to participant reactions, commentary, and reflections to understand how facilitators adapt DT sessions to participants and generate useful DEI practices [1].

Results

We asked (RQ): How can qualitative causal mapping visualize facilitators' ways of moving from explicit and implicit causes to effects? In the DT session we analyzed, the Facilitator made several linguistic and interactional moves to establish the session's tone and content and to attend to the new DEI work that would be involved. Whether by intent or happenstance, these facilitation moves emulated the DT journey of inspiration-ideation-implementation and are

captured in the language of: (1) Establishing Tone and Content: Invitation, Possibility, Reflection; (2) Exploring Design-Decision Trade Offs: Linked Resources and Support to Effects; (3) Throwing Out Curiosities and Ideas About Reframing: Reflection; and (4) Probing Underlying Premises and Making Connections: Explicit Qualitative Causality. These results follow the flow of the DT session #4 for ECE.

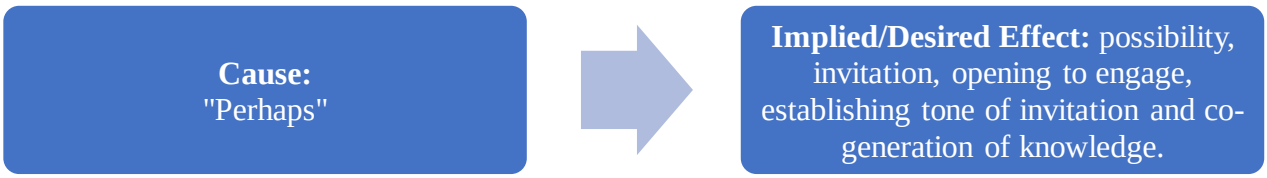
Establishing Tone and Content: Invitation, Possibility, Reflection

The Facilitator began ECE DT Session 4 by directing participants to engage in a large-group discussion about the Design Challenges (see Table 1) listed on the whiteboard. He talked through the overarching prepared questions (i.e., "What is the relationship between these challenges? How are they related to (1) diversity and inclusion and (2) professional formation? and What do we want to tackle first?"), then turned to the group. In these moves, he guided and led the DT participants [14, 22]. He seemed to want to establish a baseline of knowledge in the group since some participants might not have attended the last session. Therefore, he began by saying, "we want to go back and refresh our memories. We aren't sitting in the same places or same groups. Perhaps one person in each of the groups can refresh, remember what we were thinking about."

"Perhaps" is an adverb of probability. In this sentence, he is not expressing a directive or an explicit request but implies that he has not committed fully to the course of action he suggested (see Figure 1). He is setting the tone by inviting someone to speak and share information and offering an opportunity for others to begin the session differently. Thus, the session begins with possibility, not certainty, to invite exploration and reflection. Moreover, this tone is essential to sharing expertise and co-generating knowledge involved in DT.

All participants in the session shift their bodies and their gaze from the Facilitator to a male who self-identified as a professor and who responds to the Facilitators' invitation to begin talking.

Figure 1. Causal Map: "Perhaps"



Glancing down on his handwritten notes, this male professor begins:

> I can start. Correct me if I'm wrong, but we were talking about students who were unprepared for a variety of reasons or some unspoken cultural expectations, such as students from lower incomes, or from other countries that might not know, or first generation college students who might not know what they don't know until they get there. To bridge that gap. Those students who are absolutely smart enough but might not have the preparation to be successful. What we can do.

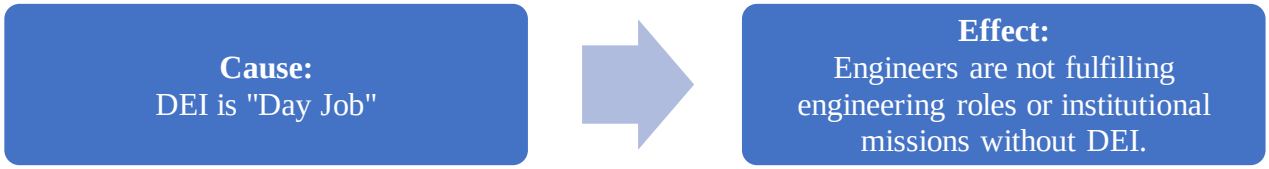
The Facilitator acknowledged the comment verbally ("thank you") and nonverbally (verbalizing and writing a question on whiteboard, "how do we work with students who are underprepared"),

then invited different topics, “Let’s move onto the second one (pause) then” into which another participant animatedly (eye contact around the room and to the Facilitator, gestures) jumped in:

> You have diverse faculty, this is the case where there are lady professors… the impact is going to be for the students to see an example, a person, a guide, and see that, not as a given, but if that situation exists it’s going to bring down a lot of the comments that people say. Um (pause)

The Facilitator immediately filled the pause such that any other potential comments by the speaker or other participants would be discouraged. The Facilitator’s action enabled him to interject a reorienting remark to keep the discussion focused without discouraging participation: “We were talking about the ‘day job’, Is this my day job? not just faculty but also staff and students, what aspects of diversity and inclusion and professional formation are part of ‘day jobs’”? In this moment, the DT session plan to verbally link DEI to roles (required tasks, responsibilities, obligations), that is, to envision DEI not as an add-on to engineering work but as an essential (necessary and sufficient) component was made (see Figure 2). This causal map implies that one cannot be an engineer without doing DEI. The previous speaker, the professor, began to talk about university “pronouncements,” to which the Facilitator then read verbatim the university, College of Engineering, and ECE mission statements, thus adding data to the discussion but also legitimizing DEI, embedding DEI within the very structure of the university and of engineering itself as a profession.

Figure 2. Causal Map: “Day Job”



At this point, the Facilitator apparently still wanted to encourage participation but also wanted to ensure that the foundational implications and perceptions were discussed so that the DT participants could avoid design fixation or prematurely moving toward solutions as needed in the information processing of design sessions [26] and as a fundamental tension in DT itself [16, 10]. He said,

> these would be a potential solution that we could begin to discuss and the underlying challenge is that we are limited in our resources, time, that our perceptions of how the world works. If we are going to value something, how do we incentivize it, right, with real value-added components like money, time, support. right. There’s always some value trade off. There is a design decision trade off. How do we optimize the situation.

At this point, he decided to be overt in his direction but in a way that would still encourage participation by implying that the previous comments were indeed paths that the session could take (“these would be…we could begin to discuss…) but that there were consequences to taking this direction at this point in the DT session. In verbalizing the consequences, he explicitly mapped causal if-then sequences (see Figure 3): “If we are going to value something, [then] how do we incentivize it…[and how do we manage the] trade off. There is a design decision trade off. How do we optimize the situation.”

Figure 3. Causal Map: "Design-Decision Trade Off"

A participant recognized that the Facilitator's statements were applicable to all of the discussion points: "I think that same thing applies to other aspects as well" (looking at and pointing to white board, seemingly fully involved and reflecting on the content and implications). The Facilitator honored this insight--"Maybe all of them. Resource constraints, value constraints, are always in that equation."—and phrased his response still with the sense of exploration and possibility ("Maybe") that would invite reflection. With this statement, the Facilitator transitioned into exploring design-decision trade-offs focusing on their implications, not their finalization.

Exploring Design-Decision Trade Offs: Linked Resources and Support to Effects

The transitional statement about assumptions and trade-offs prompted participants to speculate via statements that functioned as questions. At this point, a male participant, who probably was a student based on attire and objects (e.g., headphones, plaid shirt over a t-shirt, brown hair and beard), asked,

> …how do we…have an effective building environment to improve the classroom and support the students…what is something we can do that is primarily academically focused that can maybe cause students to interact with each other and therefore maybe those interactions would continue outside of the classroom.

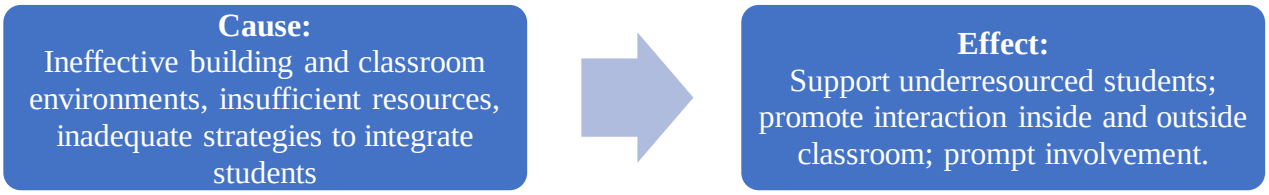
These statements implied or explicitly stated causality (see Figure 4a): if we improve the classroom environment, then we can support the students, then we can "cause students to interact" in the classroom, and then we can cause these interactions to occur outside of the classroom. The Facilitator responded, "so what was the underlying perception for why that was important? Why wasn't it happening?"

A different student interjected "I mean, I've heard from students--either transfer students or minority students or (unintelligible) students--that they do not have classroom resources, so I was really interested in trying to find ways…"

A female student said "yeah," thereby acknowledging the previous speaker with one word and following up in a way that indicated that she was continuing to discuss the same issues he was commenting on. She turned to and gestured at the whiteboard and Facilitator to discuss an observation she made:

> …and a lot of times they [students] sit in, like, the same area with the same groups. And we talked about the moving classrooms and walls and in the classrooms where professors walk around so no one knows where they'll be so that, we were saying, that maybe that promotes, like, an exchange of students in the classroom. But we talked about, like, if there's constraints, that there aren't that many classrooms like that.

Figure 4a. Causal Map: "How/What/Why Wasn't It Happening?"

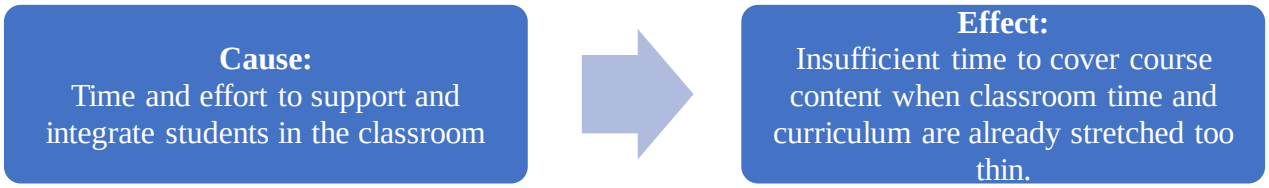


The Facilitator expanded and enriched the participant give-and-take by not suggesting that he knew the answer ("for whatever reason") but by encouraging them to "dig into that a little more":

> so that you discussed an opportunity with the dynamics but also about the constraints. Limitations about how many. And getting at the underlying issue that students for whatever reason, and we need to dig into that a little bit more, tend to aggregate with who they already know and maybe limit themselves in terms of resources, and connections.

An older participant who appeared to be a professor (attired in a dress shirt and slacks) asserted, "the other thing that I think is being actively involved, I think that the key to get students actively involved." A brief discussion ensued in which several participants expressed concerns (see linked causal mapping in Figure 4b) that spending time to promote student involvement might have "special negative consequences…you might slow down the lecture environment…already in a lot of courses, even when they rush…they don't cover the content of the course…" The Facilitator interjected, "right," before another participant said, "you're going to ask them to spend 5 minutes of the lecture getting them involved with each other, then the challenge might be, harming the overall goal."

Figure 4b. Causal Map: Unintended Harmful Consequences



The Facilitator expanded and enriched the participant give-and-take. The Facilitator joined in by acknowledging constraints and orienting participants toward underlying themes that would be part of the upcoming discussion:

> Another design-decision trade off. …How do we partition entities. How do we then integrate. I think that's another theme. In the next part we're going to see what themes link these together, what are the underlying issues that might be involved in all of these, that might be impacting all of these. Be thinking about that. (pause)

The Facilitator's pause, note of finality that this part of the discussion ended, and repositioning himself to attend to the whiteboard, enabled him to shift the focus to a different topic: "Building the bridges between and among students. That came out of a group. Does anyone want to get that?" There was a long pause in which no one spoke.

Throwing Out Curiosities and Ideas About Reframing: Reflection

Then one of the female co-authors (as participant) admitted that "we didn't get very far" with a brief laugh and an attempt to link everything together that implies that some themes are coming together and, perhaps, covering only course content is insufficient in role requirements for engineering professors as part of their day jobs:

> Building the connections for the students and that everyone sees diversity and inclusion as part of their day jobs, not a separate thing that they do but that it's everyday part of what we do, kind of leveraging some of the language that is in the faculty, trying to bring that to the whole community.

The Facilitator said "umhmmm" with a verbal nod of agreement as she continued that "seeing graduate students as being an important part of that. A very important part." Later, the Facilitator made an observation that expanded the conversation to include more stakeholders in the design process and that was greeted as humorous by participants:

> Can I throw my curiosity in there, too? We have a clear focus on long-term need for getting students interacting, but I'm curious about faculty interacting with staff, or faculty interacting with faculty. I'm just curious about why we are just focusing on students. Is the rest of that system all working just perfectly. (participants laughed)

After the laughter died down, the Facilitator quipped,

> that was a little bit rhetorical (the Facilitator laughed along with the participants, then paused) but I thought I'd throw that curiosity out there. What made us go for students and students, and what might make those other components bring into that, particularly since getting students actively involved, and that might be what you were getting at, involves faculty or grad staff or TAs as well. (Pause). What are the dynamics that we are trying to understand there?

In his phrasing of being "curious" and implying that he was asking questions because of his "curiosity", the Facilitator established himself as a co-learner in the DT process who was just trying to make sense out of all the talk. In addition, he did not try to express causalities—he did not suggest reasons for the emphasis on students or what the dynamics might be—instead he was inviting input. To this request, the female co-author, responded:

> I don't know that we, um, that we were looking at, that we weren't trying to ignore the other parts, but certainly we were trying to focus on the interactions because starting there it isn't working very well. So I'm not saying, but now might be a good time to reframe the question related to that. So I just think that we were at a starting point… (voice trails off).

This part of the DT session seemed to pause the process by lightening the mood and reflecting on what was being said and not said during the interactions. This break seemed to offer a space to reframe and refocus discussion. Of interest is that there is no explicit or implicit causal map for this part of the DT session, possibly because the tone and intent were to take a breath before resuming the hard work of designing for DEI, as exemplified by the next part.

Probing Underlying Premises and Making Connections: Explicit Qualitative Causality

From the beginning of this particular DT Session #4 for ECE, the Facilitator and participants used orientational metaphors (e.g., bringing the underlying ideas beneath the talk up to the surface). At times this language encouraged participants to discuss their observations. At other

times, the discourses encouraged them to consider what they might have neglected or what was simmering below the surface. At this point in the DT session, the Facilitator started to bring the entire discussion together using orientational metaphors and the imagery of opening up the previously closed or unstated tensions to consolidate impressions. In doing so, he directed participants to "put things together" and, in the process, reminded everyone of the DT aims regarding DEI and the professional formation of engineers:

> So I think that it's good to just notice what's coming to the surface, what is jumping out at us, what is underlying that might put other things together…this is the time for open thought, generation, ideas, questions. What we're trying to do is, what we are trying to get, [is] what's the relationship between these challenges. How are they really related to diversity and inclusion, to professional formation, and what we really want to do is where do we want to tackle that. So keep those in mind. (pause) How are these related? How do these actually impact diversity or an inclusive environment, and what is their role in professional formation? (pause)

In the casual map (see Figure 5 at the conclusion of this section), the cause or "If" statement can be worded by paraphrasing the Facilitator's quote to "If we are going to work toward DEI and the professional formation of engineers in ECE, then what do we need to do?" The causal map is positioned at the conclusion of this section because the map is bracketed by this opening to "put things together" (Cause) with the responses (Effects) running throughout this entire part of the DT session to its conclusion. The effects or "then" component of If-Then sequences are: (a) replicate sites of connection and inclusion (positive deviance approach); (b) encourage involvement and awareness (belongingness approach); (c) connect students and professors around goal-directed, technical activities (high impact learning and student-faculty engagement opportunities approach); (d) help students survive (hierarchy of needs approach); (e) feeling welcomed and not singled out (affective approach); and (f) sustain the unfinished business of DEI (tension-centered approach).

Replicate sites of connection and inclusion (positive deviance approach). In response to the Facilitator's directive to "put things together", an older male participant offered ideas concerning actual physical places that could affect DEI and individuals' involvement: "I think that there are plenty of organizations on campus… [mentions some specific campus centers/sites]…That's a place where people could get together." The Facilitator acknowledged this contribution ("So there are things happening in some places that could be models.") suggesting that there already are sites in which DEI and professional formation work is being done effectively that could be expanded, replicated with changes based on context, and scaled up. This comment aligns with deviation amplification or positive deviation approaches for social, organizational, and community change and well-being that are defined as "*intentional behaviors that depart from the norms of a referent group in honorable ways*" [27, p. 832; see also 28. Therefore, one would not need to invent new applications but could leverage the wisdom of particular groups to capitalize on what was working (see Figure 5).

Encourage involvement and awareness (belongingness approach). The Facilitator then turned to a middle-aged man with an official name badge who did not talk about specific places but about the, to him, utopian idea of communal space:

> I wonder how much of a sense of community we have as a department. I've been here for a long time--I don't feel it. And, um, the sense of community is not just for the majority

> but for everybody and includes diversity issues. And I would say for white males, I don't feel a sense of community.

The Facilitator encouraged this line of thought by affirming: "That is really important. Maybe no one feels included at all levels. maybe there are places where you feel included, maybe were you feel community." To this response, the self-identified white male participant continued, still with the tone of exploration and throwing out ideas, but offering his opinion saying, "I still don't have the answer for that":

> but I'm interested in where the students feel like they belong in the department, or at least by the time they graduate, do they feel like they are part of the department at all? My sense is "no" but I don't have the answer to that.

The Facilitator accepted the speaker's assumption and added a question, "and, if they do, at what point does it happen and why? (pause) and why… [he was cut off by next speaker]." In these and immediately previous talk turns, the participants and the Facilitator said "I think", "I wonder", "maybe", "I don't have the answer", and "If they do…", to signal that they were speculating on possibilities. At this point several speakers discussed different ways in which they and others have become involved in ECE.

Thus far, after the idea of replicating sites of belongingness and inclusion (positive deviance approach), participants described how they might encourage involvement and awareness (belongingness approach) (see Figure 5). These suggestions can foster feelings of belongingness important to member retention (sense of fit and acceptance; [29]). This involvement-awareness thread merged into the following section on connection and learning opportunities.

Connect students and professors around goal-directed, technical activities (high impact learning and student-faculty engagement opportunities approach). In this section, participants described how students' connection with professors around goal-directed, technical activities could create a more inclusionary environment and professional formation (i.e., expand high impact learning opportunities). These proposed activities and effects aligned with findings from high impact learning outcomes and results on how undergraduate education can foster life-long personal and professional results, including 21st century employability and life satisfaction [30, 31] (see Figure 5).

The interaction among participants and the Facilitator continued as a transition. At this point, a male participant commented, "for me it's whenever I interacted with a professor, I had the chance to work with…. It's a very intimate…to hear what they think about things. It's more of that level. Um I don't know, I guess it's the technical aspect… that's the kind of thing I do…" The Facilitator summarized ("…so the shared idea or focus on a technical project or idea, connected. Even if there are other differences going on. Faculty, staff, student roles.") to which the speaker said "yea" and the Facilitator ended the exchange with "okay."

Other speakers contributed their own experiences to the idea of technical collaborations, "I'd like to add to that. …something similar that I felt when I joined a research lab. Every student in the lab was working on a different project but you'd still have group meetings and help each other out. those kinds of environments." The Facilitator again acknowledged and rephrased the point ("and the group meetings help bring different people together, and hear different voices, but also

create shared experiences.") to which the woman said "yea, probably yea." There was a pause as the participants and Facilitator seemed to ponder what had been expressed.

Help students survive (hierarchy of needs approach). After the pause in the DT session, the focus shifted to the tension between community and involvement as nice-to-know-and-do and student success in class as need-to-do or survival, implying that DEI and outside classroom activities are not where students would orient when they are struggling to stay in the engineering program and university (see Figure 5). A younger male participant leaned in over the table and animatedly raised both hands:

> so, I've got two things as I want to share my perspective as an engineer from when I was an undergrad. I was probably one of these underprepared students. And I didn't actually figure out how to study properly, effectively, until like my third year.

The Facilitator murmured "umhmm" and the participant continued:

> And as a student when you either accept the risk of the payments or you fail out, typically failure is not something you wanted to consider. So community was not my priority. Actually, figuring out how to effectively attack my classes, so there's, you know, you look to people for resources in your classes for help but at the end of the day you're sort of responsible for that. So, you have to figure out how to effectively study, otherwise it's going to be challenging to think about community…I think one comes before the other as a student who is trying to be successful.

The Facilitator remarked, **"**this is a huge point. This idea that is community somehow in conflict with survival in…" but the younger male participant talked over the Facilitator to say, "I feel that community is not that important as just trying to survive. And trying to build connection, meeting with faculty, you're new, and these professors, they're scary because they know everything…" The entire room laughed as he explained:

> [As a student] you don't even know what questions you want to ask. But you do know that you need help. I found it easier to approach professors, like I had professor xxx [name] here [speaker oriented to a DT session participant], he knew who I was when I was in [named 2 classes]. 'Cause I knew how he operated his style a little bit and I knew his style, I was able to approach him. How feasible is the idea of having like rotating professors in class that kind of keeps [uses hand gesture to show sequencing of professorial rotation idea] with students as they go through their plan of study? So like having professors…[you know makes it] easier to communicate. They might even remember your name which makes you sort of feel like a person as opposed to sort of a face in the crowd. But that's sort of, um, that also depends on how much the student wants to succeed or speak with the professor.

These points about connections between students and professors, as well as being in survival mode, presented an implicit relationship among activities and interests for students. It appears the participant situated community, involvement, and connection within a hierarchy of needs, much like Maslow [32] did with his hierarchy of prepotency that contended that lower-order or physiological needs such as food and shelter would need to be addressed before higher-order needs such as belongingness and self-actualization would become activated. Although the strict linear hierarchy has been refuted by research, the student's lived experience situated his survival or sustained membership through passing grades as more significant and his primary goal.

Feeling welcomed and not singled out (affective approach). Following the student's remarks, the Facilitator commented by saying "so having someone know your name. Recognize you as a person. That's part of being, feeling…", the participant interjected, "yea" as the Facilitator concluded with "…included." There was a quick back-and-forth with one word from participants here and there before the Facilitator directed questions to the professor whom the younger participant gave a shout out to in the quote above. The Facilitator asked the professor: "… how did you pull that off? How did you get to know…sounds like a miracle…"

The professor laughingly asked, "do you have the impression that I knew everyone in my classes? I know about a third of them" to which participants in the room responded with laughter and one woman said with a smile, "his secret is out", and the Facilitator commented "everyone thinks you know them …." Several people talked then the Facilitator transitioned the conversation to the heart of this issue, again by posing the issue as a point on which he was "curious":

> I'm curious, I'm not picking on you [addressing the professor], but I'm, thinking that correlation. The students who are here, the ones you knew. The students that are not here, maybe not the ones that you don't know. What does that say? Not on you, but in general why did you come to know those students. What was that dynamic? And they continue to be involved. What was the student, the faculty, the class relationship?

The professor pointed to a female student across the room from him and remarked "that she was in his class last fall". She then talked saying, "I would come to ask for help" and that prompted her to "get more involved." The Facilitator asked her, "what gave you the confidence to get over that hurdle, to seek out help from a faculty member who knows everything?" to which she laughed and responded, "to do well in the class". The Facilitator created an explicit causal statement summarizing this exchange: "so you were linking your survival in the program with building some connections" but the woman student countered with "no, not necessarily. More like seeking the help to do…" (the Facilitator jumped in with "to do your best") but a different female student added nuance when she asserted, "It was more like he was going to help me be the best. So…[I was] only one there [in office hours, asking questions]… how are those students doing the homework. And to be honest, I don't really know…. [he was] helpful… other students don't know…(soft voice)

As her voice trailed off, the Facilitator interjected empathically, "but it could also be intimidating" to which the speaker said "yea." A different male student picked up the interactional thread ("to piggy back") and said that he believed that knowing that others had questions and that students did not have to ask alone was really helpful:

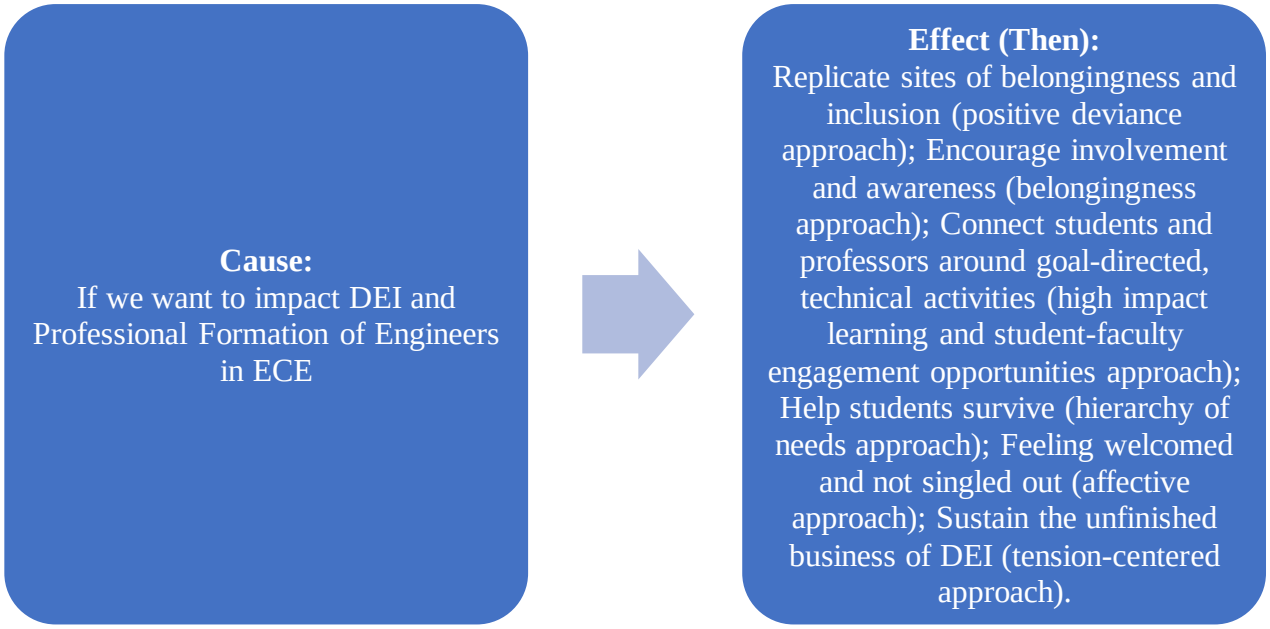
> to piggy back off of your point, I like the one-on-one time with professors but I also found it really effective to connect with other students and the professor whenever there's several students. The math classes that I recall struggling with…[I would] show up and there would be a line of three or four people and we'd be sharing questions. And when someone would be asking a question the rest of us would be listening and trying to figure out what is going on. As a group you feel strong, not necessarily being singled out, and there's that basic mindset of, of, if I don't have to be the center of his focus, then I don't have to be wasting his time or my own. There's a perspective that you have with the professor…you want to come prepared with questions. And it's really hard because you don't know what questions to ask.

In feeling welcomed and not singled out, participants experienced the affect, or shifting feelings that often go unnoticed and lie beneath talk and interactions [33, 34], or sensate experiences of warmth, trust, and empowerment [35] that can shape any life experience from homeless people's and patients' satisfaction with healthcare [36, 37] to international students' engagement in residence life [38] (Chong & Razek, 2014). Feeling welcome is not simply for the students in this DT session who felt underprepared or who had questions about course materials, but also is for members of engineering who are viewed and treated as different, including girls [39], LBGTQ+ engineering students [40], and women of color engineering students [41] (see Figure 5).

Sustain the unfinished business of DEI (tension-centered approach). Although not directed to do so, participants were thinking about implementation, as reflected in the following comment voiced by a male participant at the back of the room who had not yet spoken:

> …mini-communities in ECE… [that current practice] favors some students… maybe a healthy bunch… in other departments like xxx, students actually have faculty as their academic advisors during their undergrad… if not their academic advisor, they meet with the students regularly to give advice on where they are going …that might be harder to scale but … they [professors] know the 20 students that are with that professor…

Figure 5. Causal Map: "Put Things Together"



To this statement about the multiple levels (i.e., dyadic or relational, mini-communities, "scale up" to the institution), the Facilitator responded with a mini-lecture ("brief point") then opening or invitation ("I'm curious") for reflection:

> so, brief point. The different organizations, and communities can structure themselves differently. They don't have to be one monolithic. But you said community of communities. One of the things I'm curious about, but there is one thing what's the level of diversity, they become inclusive, siloed, inclusive of the people who are in it and

> exclusive of the people who are not. I am curious, what do you think about that. If we are including only those with whom we have something in common, what does that mean about increasing diversity.

Participants responded with a series of experiences, often ironic. One male participant reflected on the time when he ran into someone who came to join his organization then the potential newcomer never joined. He confronted the individual by saying,

> I have experience, well I don't have a solution, I have experience….[I approached the newcomer saying] I was wondering …you didn't join. so I said you started the process of joining but you didn't join. Why did you stop? And they said that everyone at xxx [organization] seemed like a clique, seemed like such good friends that it seemed like I couldn't enter that.…we thought we were doing everything right, we thought we were friendly and inviting and I think that there are new members every semester but how do you make it seem like, not like it's a silo. Everyone wants people to come in, to meet them, to join, but it's hard from the outside to actually do that, to feel comfortable doing that.

Other participants talked about the effects of having research groups, using acronyms, offering different opportunities ("not forcing me to do things I don't want to do"), encouraging group study sessions, and different learning styles ("I don't like learning with others, I like learning alone, especially in a lecture study…"). Although participants continued to talk, the Facilitator closed off comments and ended the DT session:

> What actually does diversity and inclusion mean in the context of electrical and computer engineering? It's not going to be the same as…[different types of] engineering or somewhere else on campus.

In these concluding remarks, the Facilitator alluded to the facts that the prototypes that would be generated would be developed specifically for ECE ("It's not going to be the same.") rather than other Schools and that the conversation would continue by posing a question ("What does diversity and inclusion mean…?"). In this way, the Facilitator did not provide closure by summarizing or bringing all the elements of the session's discussion together in a neat package. Instead, he left participants suspended in their judgments—thus, sustaining the unfinished business of DEI and of the DT process (see Figure 5)--neither and both one idea or/and another, and, in other words, as unresolved tensions about how to think, do, and value DEI that is key to sustainability of efforts for complex issues (for tension-centered approaches, see [42, 43].

Discussion

Facilitation of DT and other kinds of group sessions have been understudied and varied in emphases on facilitators' styles, goals, language, negotiation of DT structures, practices, and tensions. By incorporating qualitative causal analysis into this mix of interdisciplinary scholarship, we offer a means of visually "map[ping] the logics—ways of knowing, being, valuing, and engaging in purposeful action—without insisting that such maps be predictive and deterministic" [19, p. 243]. In doing so, we bring together the facilitators' and DT participants' expertise and engagement in DT phases to

> gain insight into why, how, what, and when both marginalization and privilege occur. In turn, those insights can catalyze the generation of uniquely useful, necessary understandings of the ways in which individuals and communities rely on discursive formations that indicate how particular events, actions, and utterances are wielded to

> benefit their interests, particularly in circumstances that are ambiguous, politically charged, and/or fueled by oppositional sides. (p. 244)

There are no easy linear paths in trying to make sense of complex phenomena like marginalization and inclusion. However, facilitators can surface the implicit causality that underlies what people say and do to navigate tensions inherent in DEI and DT processes.

In visually depicting the implicit and explicit causality in what participants say and do about DEI, facilitators challenge participants to locate spaces where DEI efforts seem to be achieving their goals of inclusion and belongingness. These sites are locale-specific, meaning that what is said in one engineering school culture at a specific college of engineering and university might not be applicable in another situation. As shown in our causal maps, facilitators can build a repertoire of strategies for digging into phrasing and experiences particular to the site without stifling input by using the beginning of causal sequences, namely, if, perhaps, what if, hypothetically, I-am-curious, what do/would you think, and so on. By taking the role of co-learner during sessions, facilitators can encourage input. By displaying causal maps from a previous session, facilitators can display how participants express the "then" in "if-then" statements to show participants how what they themselves say and do can erode or build inclusivity and belongingness.

We acknowledge that we only explored one session out of 6 for ECE and also did not present a comparable analysis for the BME sessions. Thus, our findings are based on a small sample of a limited number of ECE members who volunteered for the DT sessions. As such, these participants might have been more inclined to value DEI. In cases where participants are not necessarily on board for DEI, one of two or more facilitators can pose "if" questions or phrases about what would sustain or build greater excellence in their schools and alums' marketability. At the conclusion of the session, the other facilitator(s) can display the participants' causal mapping to show where assumptions and direct actions forestall the inclusivity that can foster greater innovation and professional formation of engineers.

To close, we recommend that engineering educators use this methodology when teaching DT and other design model practices so that students, researchers, and other engineering educators better train participants and facilitators of group sessions. With further scholarship on facilitation, we contribute to developing a tool kit to incorporate emerging research on facilitation and our contributions to qualitative causal mapping. Such a toolkit and recommendations to modify facilitation for particular groups [1], offer opportunities for practice that could help work toward DEI productively and prevent unintended negative consequences in DEI sessions.

Acknowledgements

This associated activities and data collection for this study was made possible by a grant from the National Science Foundation (EEC-1636446). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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