Board 216: Building Community for Inclusive Teaching: Can We Bridge the Valley of Neglect?

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Abstract

This work describes an effort to nudge engineering faculty toward adopting known best practices for inclusive teaching through a program called Engineering is Not Neutral: Transforming Instruction via Collaboration and Engagement Faculty (ENNTICE). This monthly faculty learning community (FLC) followed the three-year structure of the Colorado Equity Toolkit: Year 1 (reported in 2022) focused on self-inquiry including reflection; Year 2 (reported in 2023) focused on course design including training new engineering faculty; Year 3 (reported in the current paper) focused on building community. The emphasis on building community allows us to address our research question: To what degree does faculty participation in an FLC impact engineering college culture? Building community is measured through broadening participation *by faculty* in known best practices for inclusive teaching, including three elements of interest. First, we share within our engineering college the progress each department has made toward inclusive teaching participation, using thermometer-styled graphics like those used to illustrate progress toward a fundraising goal. Second, after reviewing certain sections of our engineering college's plan for diversity, equity, and inclusion (DEI), we submitted brainstormed ideas for implementation to our dean's office. And third, after reviewing reports from student focus groups conducted in 2020/21, we evaluated progress and made recommendations for next steps; in this context the clarity and urgency of the student feedback is both motivational and difficult to ignore. The common theme in each of three elements is seeking to bridge the valley of neglect that so often divides scholarly work about DEI from concrete changes that benefit students, employers, and the broader community.

Introduction

To broaden participation, the United States needs to engage the "missing millions" [1] of Americans who are currently underrepresented in science, engineering, technology, and mathematics (STEM) [2]. This need has prompted a challenge for everyone currently working as a STEM professional to take action supporting diversity, equity, and inclusion e.g., [3].

To answer this challenge, the engineering college at the University of Colorado Denver (CU Denver) planned, developed, and administered a three-year engineering faculty learning community (FLC) whose mission was to nudge engineering faculty to adopt known best practices for inclusive teaching—where we note there is enormous overlap between *inclusive teaching* and *good teaching*, such that promoting inclusive teaching helps all students [4]. The premise for this work that, while there is a vast literature on effective pedagogy in engineering education e.g., [5], [6], [7], we are only beginning to learn how to propagate the best practices to engineering faculty not directly involved in education research or change efforts [8]. This work seeks to propagate best practices through *nudging* [9], a Nobel-prize winning theory from behavioral economics that posits that people will make better choices—without bribery or threats—when the choice architecture is designed appropriately. For example, setting the default to enroll into a retirement program, while still allowing employees to opt out, increases the proportion of employees saving for retirement [9].

The structure of an FLC was chosen because FLCs have been shown to promote active learning [10], and the three-year duration of the FLC was inspired by the prior success of the program Teaching to Increase Diversity and Equity in STEM (TIDES), which promoted inclusive teaching in computer science departments at a constellation of American universities [11]. The FLC was organized as a community of practice following guidance from Kezar et al. [12]. The name of the FLC, Engineering is Not Neutral: Transforming Instruction via Collaboration and Engagement Faculty (ENNTICE) was chosen to emphasize that, while engineering faculty may think of themselves and the subjects they teach as objective, students often make no such distinction between the nature of the subject and the application of the subject [13]. On the contrary, students need to know how engineering supports their values.

With encouragement from the engineering dean and the five engineering department chairs, ENNTICE was successful at recruiting at least two faculty volunteers from each of the five departments in its first academic year 2021/22. Recruiting at least two faculty was intentional, because it empowers the professor to speak about issues related to diversity, equity, and inclusion (DEI), knowing they will have at least one ally at their department faculty meeting. Recruiting volunteers was also intentional, because it facilitates the intended cultural change by starting with a motivated cohort of early adopters. As the ranks of faculty trained in inclusive teaching grow, the perceived normalcy of the best practices may nudge a few (although not all) skeptical faculty toward better practice.

The three-year FLC followed the three-part structure of the Colorado Equity Toolkit [14], which is a freely available collection of curated resources to support inclusive teaching at all levels from primary through postsecondary education. During 2021/22, the first year of the FLC, ENNTICE emphasized self-inquiry, reflection, and mindfulness [15]. During 2022/23, the second year of the FLC, ENNTICE emphasized inclusive course design [16]. Here we report selected results from 2023/24, the third year of the FLC, when ENNTICE emphasized building community. These results have been selected to answer the research question: To what degree does faculty participation in an FLC impact engineering college culture?

Methods

For the purpose of this study, *building community* is measured through broadening participation *by faculty* along three elements of interest: (1) Measuring and reporting engineering faculty participation in professional development for inclusive teaching including, but not limited to, ENNTICE; (2) gathering suggestions for implementing the engineering college's DEI plan and transmitting those suggestions to college DEI officer; and (3) reviewing a focus group report that articulated feedback from minoritized engineering students in 2020/21, then gathering suggestions to improve the college and its five departments in light of that feedback. The first of these three elements was designed to nudge more engineering faculty to participate in the FLC, while the second and third elements, honoring the commitment and expertise of the participants in the FLC, were designed to empower the FLC as an in-house advocacy group for inclusive teaching.

To measure engineering faculty professional development, in the fall semester of 2022, the engineering dean's office provided a list of 73 rostered faculty (*viz.*, faculty with titles ending with *instructor* or *professor*). After breaking this list into five department-specific lists, each department chair surveyed their department to determine who had participated in what professional development and when. The list of professional development opportunities included ENNTICE, TIDES, Aspire Summer Institute [17], Engineering PLUS [18], and another program at CU Denver called the Inclusive Pedagogy Academy [19]. For each department, the participation target is for ≥50% of faculty to participate, which was chosen based on the assumption that the perceived value of professional development for inclusive teaching will increase once a majority of rostered faculty have participated—in other words, the intent is to transition from early adopters to those seeking to avoid being left behind. Late in the fall semester 2022, the participation rate for each department was calculated as the number of participants divided by the participation target. A graphical representation of each department's participation was presented as a thermometer (Figure 1), where 100% would correspond to meeting the department's participation target. These graphics were then presented by an FLC participant (or participants) from each department in the first department faculty meeting in the spring semester 2023.

To gather suggestions on the engineering college's DEI plan and the 2020/21 student focus groups, the ENNTICE workshops in October 2023 and November 2023 focused on those topics, respectively. Before the October workshop, the DEI plan was transmitted to the FLC participants, who were asked to focus on the two-page section on pedagogy (Table 1). Then, during the workshop, following a think-pair-share protocol [5], participants discussed the pedagogy section and offered suggestions for implementation. At the end of the workshop, each participant completed a written feedback form to summarize their suggestions.

Figure 1: Thermometer graphic showing how close each engineering department is to reaching its goal for engineering faculty to complete professional development in inclusive teaching.

Table 1: Summary of the pedagogy section of the CU Denver engineering college diversity, equity, and inclusion (DEI) plan.

Year 1 (2023) Goals: 1. Work with the Center for Excellence in Teaching and Learning (CETL) to provide a series of very short talks at department faculty meetings to introduce active learning techniques to more faculty, demonstrating the simplest techniques to introduce. 2. Ensure videos used in teaching are captioned to support hard of hearing and English language learners. 3. Invite guest speakers who are from under-represented minority groups (URMs) to share their professional experiences in classes. 4. Facilitate computing experiences that deliberately build from course to course, by having instructors coordinate curriculum to have explicit linkage. 5. Encourage instructors to develop projects that are design- and team- based. Include training for instructors on DEI-related aspects, such as how to not strand URMs or women on teams, and deal with micro-aggressions between teammates.
Year 2 (2024) Goals: 1. Create a system of incentives and assessments for introducing active learning, flipped classroom approaches, and continual improvement to pedagogy to realize our design-based learning aspirations. 2. Encourage a "See it, Be it" strategy by providing resources to faculty that make it easy for them to include examples of successful engineers of all backgrounds and/or show examples of great engineering from multiple cultures. 3. Create low-cost boot camps and summer courses to strengthen math and technical skills for struggling students.
Year 3 (2025) Goals: 1. Create a cycle of class observation and review of all faculty that provides suggestions for implementing active learning techniques, with follow up to help iterate on these practices.

Before the November workshop, the student focus group report was transmitted to the FLC participants, who were asked to review the report in light of the previous 2½ years of FLC training. The student focus group report, commissioned by the engineering dean's office in 2020/21, summarized one focus group discussion with volunteer participants from each of American Indian Student Services, Asian American Pacific Islander Student Services, and the student chapter of the Society of Women Engineers. The three focus groups, each 75 minutes long, were organized and conducted by The Evaluation Center, a self-funded branch of CU Denver that provides professional evaluation services. The Evaluation Center provided a $15 gift card to each student participant, de-identified and coded the transcript of the recorded discussions, and summarized emergent themes, some of which are captured in the following selected student quotations:

> "For the most part, it's mostly men who are in the engineering department. Seeing someone else who is also a woman makes it easier for me to reach out if I have any questions."

> "I moved to [another major] because it explained what was happening to me as an Indigenous STEM student. I felt unsafe, marginalized, pushed out, invisible, not supported, and isolated."
>
> "I do have to conform to more white, hegemonic androcentric norms and definitely tone down the femininity. Also, even though I have felt supported by staff, I have also felt betrayed, specifically, with the types of subtle messages that we receive."
>
> "Let's see what CU Denver and the College of Engineering shares with the rest of the university after this and where it goes from there. I challenge them to do something with this."

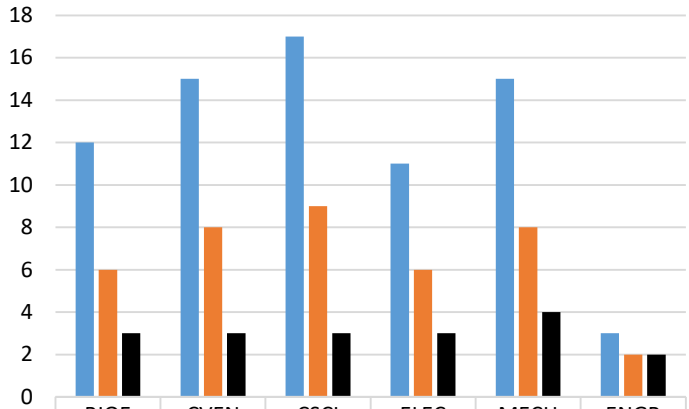
During the workshop, again following a think-pair-share protocol, participants discussed the student focus group report and offered suggestions for implementation. At the end of the workshop, each participant completed a written feedback form to summarize their suggestions. Then the ENNTICE leadership summarized those suggestions and conveyed them to the engineering college DEI officer.

Results

Participation in professional development for inclusive teaching is shown in Figure 2, and progress toward each department's training target is shown in Figure 3. Two of the three faculty rostered in the dean's office participated in ENNTICE, making that unit the first to accomplish its training target. The five departments, at the midpoint of the three-year FLC, were 33% to 50% of the way to their training target. After showing the civil engineering department thermometer (Figure 1) in the first faculty meeting of 2023, one additional civil engineering professor joined ENNTICE, bringing that department to 50% of its training target.

Responding to the pedagogy section of the engineering college DEI plan (Table 1), the FLC suggested the following ideas to support implementation of the DEI plan:

- Most important goal: Create a cycle of class observation and review.
- Designate and compensate someone to take charge and coordinate.
- Without metrics faculty will not focus on doing these things.
- Start with a few faculty in each department—perhaps those from ENNTICE.
- Change must be efficient to mitigate risk to faculty, especially to junior faculty.
- Allay fears that inclusive teaching could backfire and hurt struggling students.
- We must consider not just how we teach, but what we teach.
- Institutional support is important—money, time, materials.
- Rebuild the reward system.



	BIOE	CVEN	CSCI	ELEC	MECH	ENGR
Rostered Faculty	12	15	17	11	15	3
Training Target (≥50%)	6	8	9	6	8	2
Faculty Trained	3	3	3	3	4	2

Figure 2: Rostered faculty, training target (≥50%), and faculty trained in the departments of bioengineering (BIOE), civil engineering (CVEN), computer science and engineering (CSCI), electrical engineering (ELEC), and mechanical engineering (MECH). In addition, data are reported for three faculty who are rostered in the dean's office (ENGR). Figures from fall semester 2022.

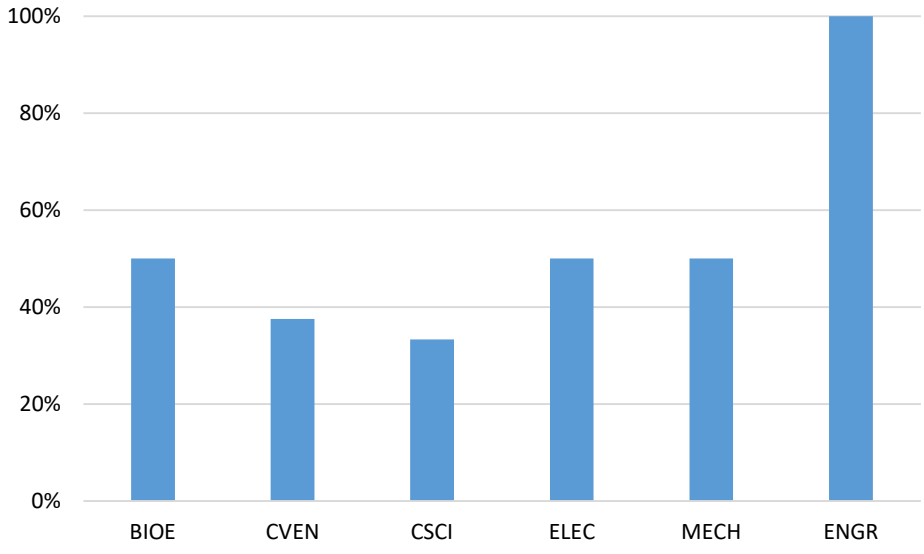


Figure 3: Progress of each engineering department at reaching its ≥50% training target for inclusive teaching. Figures from fall semester 2022.

Regarding the discussion of the student focus group report, FLC participants provided written responses to four questions (Appendix). Responses to the first question—did the comments surprise you—varied widely from a clear yes to a clear no. Those responding *yes* were more likely to be men or faculty for whom ENNTICE was their first professional development for inclusive teaching (beginners); those responding *no* were more likely to be women or faculty for whom ENNTICE was not their first professional development for inclusive teaching (experts). FLC participants used emotional language—*surprised*, *eye-opening*, *disappointed*, *angry*—which is itself unusual in the practice of engineering [20]. Responses to the second question—do students share with you—also varied widely from a clear no to a clear yes, but with the opposite pattern from the first question, with those responding *no* more likely to be men or beginners, and those responding *yes* more likely to be women or experts. One participant wrote a parenthetical statement "more mature," perhaps suggesting an opinion that sharing feedback on DEI is a sign of immaturity; this sentiment was not reflected in the other feedback. When asked to suggest questions for a follow-up focus group, there were two themes: First, FLC participants wanted to know if things were improving (or not). Second, FLC participants called for a broader cross-section of CU Denver students including Black students; Hispanic students; lesbian, gay, bisexual, transgender, and queer (LBGTQ) students; and white male students. For the final question—what each department could do to address student concerns—there was a breadth of responses (Appendix). When asked what each department could do, one FLC participant summed it up with, "A lot."

Discussion

Regarding the participation thermometers (Figure 1), considering that the training target is for ≥50% of rostered faculty to participate in professional development for inclusive teaching, the participation results of 33% to 50% of the training target (Figure 2 and Figure 3) are modest. The modesty of these results reflects the voluntary nature of the FLC. These results also emphasize the challenge of engaging engineering faculty in the scholarly work of diversity, which is often undervalued compared to traditional engineering technical research [21]. On the other hand, having approximately ¼ of engineering faculty (that is, about 50% of 50%) participate is itself an accomplishment, considering that the fraction may have been much smaller without ENNTICE.

One idea from the October 2023 examination of the engineering college DEI plan merits further discussion. One phrase included in the DEI plan is, "We do not need to change what we teach, but we need to reexamine how we teach." In other words, while the equations are the same at every university around the world, the application of those equations certainly depends on the local context including, to quote the accreditation body ABET, "global, cultural, social, environmental, and economic factors" [22]. But this notion was contradicted by one of the FLC participants, who argued the opposite: We must consider not just how we teach, but what we teach. To elaborate on this point, consider the mixed success of numerous engineering projects in the recent history of the United States, where dams [13], facial recognition [23], and highways [24] have all provided disproportionate benefits to majority populations and disproportionate costs to minority populations. There is hope, because there are known best practices to mitigate these disproportionate benefits and costs. But students will not learn those best practices unless we include them in our curricula. This leads to a key question requiring further work: How can we change what we teach in our courses to make engineering a more inclusive profession?

There is a common thread in a pair of comments, one from the DEI plan discussion in October, and one from the student focus group discussion in November. Responding to the DEI plan, one FLC participant wrote, “Rebuild the reward system.” Responding to the student focus group report, one FLC participant wrote, “Elevate being a faculty sponsor for a student group—make it count more for [promotion and tenure].” The common thread is the competitive environment in which tenure-track faculty must build their reputation by leading a research group funded by competitive grants with results published in competitive refereed journals. Although this competitive environment does not characterize every American engineering college, it characterizes many, and in those colleges, it has the effect of rewarding traditional engineering technical work at the expense of teaching, including inclusive teaching. If one takes as given that actors respond to their perceived reward environment, it is not surprising that many engineering faculty emphasize technical research while minimizing teaching, especially if one’s construction of teaching includes—as we think it should—the effort required to meet students where they are. This thread requires further work, either to efficiently integrate inclusive teaching into the existing reward system, or to fundamentally change what counts in engineering.

Conclusion

Let us conclude with a few comments about bridging the *valley of neglect* that we defined in the abstract to be the missing link that divides scholarly work about DEI from concrete changes that benefit students, employers, and the broader community. On the one hand, there is a phenomenal body of literature informing the practice of engineering education in general, and inclusive engineering education in particular. On the other hand, even at an engineering college where a sizeable percentage of the engineering faculty volunteered for a three-year faculty learning community, student focus groups inform us that we are not there yet—at all.

Here we have described three aspects of the ENNTICE program at CU Denver aimed at building a community of engineering faculty who are trained and prepared to function as change agents. Those three elements are nudging faculty to participate, engaging them to champion their college’s DEI plan, and presenting them with the challenge articulated in the student focus group report collected three years ago. All three aspects seek to pivot the FLC from a primary mission of training to a primarily mission of change.

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Appendix: Faculty learning community (FLC) responses to prompted by the discussion of the student focus group report.

1. Did any of the comments from the students in the report surprise you?

"Yes, especially the negative strong opinions/feelings."
"I was surprised to hear how often female students are experiencing discriminatory behavior."
"Yes, many. I felt I was exposed to some good number of experiences our students have had, but this report was eye opening.
"Not really."
"No, sadly."
"Clothing? Females thinking and changing outfits based on major!!??"
"Not really, but disappointed this is still happening (from 1989 when I was in college!!)"
"Not surprised. Confirmed the bad situation we are in. Not being supported, are not heard, are not recognized."
"A little bit angry that this sort of thing happens was more the feeling."

2. Do you find students share similar feedback with you?

"No, not at all. Without asking, I would not know these important perspectives."
"Not really, my students are mostly graduate and senior [undergraduate] (more mature)."
"Not often—we don't always get this feedback directly—often, the impacted student just fades away."
"I have not heard from students about overtly racist issues. But I have on some of the other feedback."
"Some similar feedback [has] been shared with me."
"I have had a handful of students over the years who have told me about discrimination they have experienced from professors and lab mates."
"All the time, [as] female faculty in [engineering], I need to bear the load, while I know that I am not an expert in helping students professionally. I can only empathize with them."

3. When we redo these focus groups, what questions should we ask students?

"Ask to give at least one positive comment!"
"Ask if anything seems to be improving? If so, what?"
"Ask if issues are different [in] online classes vs. in-person classes?"
"Have you noticed any changes (positive or negative) in these issues during your time here?"
"We should consider questions that would help us understand the differential case of 'in-person' and 'online' education."
"Include more affinity groups: LGBTQ/gender non-conforming, Hispanic/Latinx, African American, White male?"
"It would be good if we created a longitudinal version where we check in with the same students over multiple years."

4. Given the discussion today, what could each department do to address student concerns?

"A lot."
"Bring students into the conversation."
"Incorporate DEI training into team-based courses."
"Mid-term customized [faculty course questionnaires]."
"Make administration read and reflect on these kinds of reports."
"Promote the idea that you have the ability to help as a bystander."
"I'm not sure if this is an issue to address in departments. It is a much bigger issue."
"Emphasize a [percentage] of faculty getting more training on diffusing student-on-student harassment."
"Elevate being a faculty sponsor for a student group—make it count more for [promotion and tenure]."
"Midterm [faculty course questionnaires] for faculty to read themselves to 'make changes in the moment'."
"For me, a dedicated faculty meeting at each department to review the report and operationalize actions to address the concerns."

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