

Work-in-Progress: Exploring Students' Perception of Engineering Classrooms with bell hook's Engaged Pedagogy

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Introduction

Queering, grounded in queer theories, focuses on constantly pointing out “features” that impose cisgender and heteronormative elements in the systems we live in and actively engaging in changing said systems (Letts & Fifield, 2017). Historically, engineering as a field has been unwelcoming to the people who identify with the LGBTQIA+ community. Exploring how engineering students perceive their learning environments can be a vital first step toward queering engineering classrooms and pedagogies. Such efforts should be continued, along with others, to broaden the participation of engineering and STEM fields in general. This, in turn, creates a more equitable engineering field that can be welcoming and comfortable, and encourage authentic selves while learning and practicing engineering. Studying these perceptions can potentially identify “features” that have been perpetuating the unwelcoming and uncomfortable environment that makes the participation of LGBTQIA+ engineers difficult. Specifically, this pilot study can contribute to reimagining how the pedagogical and assessment approaches in classrooms help with such research by engaging the students to help with the reimagination, which I find to be a knowledge gap in engineering education scholarship. To do so, I plan to conduct a survey based on bell hook's engaged pedagogy as a provocative lens to provoke thoughts from the students by having them reflect and juxtapose their current learning experience in engineering classrooms with hypothetical environments envisioned by hook. The outcome of such reflection and juxtaposition can provide foundational knowledge to assist in the efforts to identify “features” in engineering classrooms and pedagogies that perpetuate cisgender and heteronormative elements in engineering education. It must be noted that this is a pilot research study that strives to produce knowledge to help contribute to future efforts to reimagine engineering classrooms and pedagogies. Thus, no direct engagement with faculty and administrators is expected in this pilot study.

Literature review

In engineering education, literature on pointing out the “features” that impose cisgender and heteronormative elements in engineering education from the perspectives of queer participants has been growing for the benefit of the community. The recent publication of the book by Cross and colleagues (2022) has demonstrated the long-overdue growth in exploring and understanding queer experiences in the STEM field with the goal of exposing the “features” that we can work on addressing to create a more welcoming environment for queer engineers and engineering students. Past works have trailblazed to the current state with works from various authors that focus on such components. Cech and Rothwell (2018), for instance, studied queer students from eight universities to examine their experience and found great marginalization and devaluation while participating in engineering, as compared to peers who do not identify with the LGBTQ community. Other works by Cech and colleagues also began to uncover the heteronormativity of the engineering culture, framing engineering as a gendered practice using Wendy Faulkner's technical/social dualism (Cech et al., 2017; Cech & Waidzunus, 2011; Faulkner, 2000, 2007), where issues close to the LGBTQIA+ community are cast as too “social” or “political” to be related or relevant to engineering in general. Leyva and colleagues conducted a literature review on research that applies technical/social dualism in exposing engineering as a heteronormative, masculine, and white space (L. Leyva et al., 2016). They found that continued

use of ethnographic methodology to center queer students' experience in the process can be powerful in efforts to establish gender-neutral spaces in engineering. Existing research highlights the "*heterogeneity of engineering practices*" and "*advances the study of gender as a sexualized construct in engineering*" (pg. 8). These are some seminal works that have paved the foundations for queering engineering culture.

There are also works that contribute to the queering of engineering education from a knowledge perspective. In a passionately argued chapter, Slaton and colleagues (2017) stated that "*positivism ... promising not knowledges but a singular, stable knowledge. It is that singularity that enables a comparative judgment regarding each student or worker: How much knowledge has each individual attained?*" (pg. 321) This quote signifies the power of engineering knowledge, which is typically seen as only having correct answers to oppress those who are seen as "attaining insufficient knowledge to be an engineer." This structure dictates how education should happen in engineering classrooms and how one should practice in the larger engineering environment. Riley also critiqued the engineering knowledge from the assessment perspectives. She argued that assessments, and how engineering is being taught, typically point toward the rigidity of engineering knowledge, which holds a gatekeeping role in creating unwelcoming environments for those who are not of the dominant groups, including queer students and engineers (Riley, 2012, 2014, 2016). Overall, these works have shown efforts to expose the "features" of engineering education, particularly from the cultural and knowledge perspectives. However, as I will review next, such efforts are lacking from the engineering classrooms and pedagogical perspective.

Queering engineering classrooms and pedagogies

Queering also extends to engineering classrooms and pedagogies, though research is scarce in this context. One of these studies examines first-year engineering students' conceptions of "What it Means to be an Engineer" in a summer bridge program using critical pedagogies (Taylor et al., 2017). The authors found that by using critical pedagogies in the program, students demonstrated a shift in their conceptions of engineering and their own identities while the focus moved slightly away from focusing on math and science, and themes of collaboration emerged from the shift in conceptions. Butterfield and colleagues (2018) focused on a bigger picture of the department and classrooms, with strategies revolving around areas such as the setting of the classroom tone. They found that having actions from the faculty, such as sharing diversity statements and pointing out the presence of diversity, can be useful in creating an inclusive environment. In addition to this, addressing unacceptable and marginalizing behaviors immediately can help set the tone. Inclusive pedagogy has also been mentioned as one way to create curricula in engineering using the sociocultural learning framework, which can be considered queering engineering pedagogies (Farrell et al., 2021). There are other studies that focus on queering environments in different contexts in addition to classrooms and programs, such as a reading group (Bakka et al., 2021) and theater productions (Cieminski, 2019). These studies have shown the potential of queering classrooms and pedagogies, though there are gaps that our community should begin to address.

As part of challenging the neutrality in undergraduate STEM pedagogy, Leyva and colleagues (2022) argued the need for a research agenda that "interrogates neutrality in undergraduate STEM pedagogy to disrupt curricular design, classroom instruction, and inequitable support that marginalize queer and trans students of color (QTSOC)," with the acknowledgment that STEM pedagogical practices research from the queer perspective is

missing. Specifically, the researchers asserted the need to explore, examine, and interrogate asociality in engineering classrooms including the relationships between STEM faculty and peer relationships. I embrace this challenge and argue for the need to examine the potential to shift faculty/instructors' perceptions of students from someone focusing only on learning technical knowledge to someone who is a whole human being experiencing learning and life within engineering classrooms and pedagogies. My proposed study will begin to address this using bell hooks' engaged pedagogy framework.

bell hooks' Engaged Pedagogy as the theoretical, provocative lens

bell hooks, one of the most celebrated and revered scholars and teachers in critical pedagogies and education, argued for the need for engaged pedagogy in classrooms. Engaged pedagogy (1993) is the philosophy anchored in several components of teaching: “the union of mind, body, and spirit of the students, or seeing students as a whole human being,” “students as active participants in the classrooms,” “teachers as self-actualized individuals and healers,” and “connections of life practices with things learned in the classrooms.” hooks asserted that for learning to happen, a teacher has to be their authentic self before they can help and heal their students and treat their students as whole human beings, not as individuals who come to be “processed” as part of the larger system.

Engineering classrooms are notoriously depoliticized and dehumanized (Cech, 2014; Slaton et al., 2017). As previously described, works have uncovered “features” from various lenses to illustrate the “technical” and “system” features of engineering learning environments, particularly with the use of technical/social dualism that dehumanizes and the idea of “neutrality” that depoliticizes engineering (Cech, 2014; L. A. Leyva et al., 2022). By using engaged pedagogy, I aim to “provoke” first and second-year engineering students at an emotional level by having them juxtapose their current engineering learning experiences with the possibility of engaged pedagogy being practiced in engineering classrooms. With this, I strive to answer the research question: *What are the features in engineering classrooms and pedagogies that affirm and support, or challenge and devalue students' authentic selves, especially queer students?*

Proposed Methods

This is a pilot study that will engage the first-year and second-year engineering student communities at a teaching-focused institution east of the United States. The reason for not focusing on queer students for this part of the pilot study is that it is important to understand how engineering students, in general, perceive engineering classrooms and pedagogies using hook's engaged pedagogy. This approach has the potential to reveal “features” that may marginalize queer students from the perspective that engineering classrooms and pedagogies can be dehumanizing. I will have the students answer an informational questionnaire, which will include prompts that may “provoke” them by comparing their current learning experiences with the experiences that could occur with engaged pedagogy as the teaching philosophy. The questionnaire will primarily consist of open-ended questions, with each question being paired to ask about their current experiences alongside hypothetical learning environments. This approach can get them to reflect on their current experiences. Example questions are shown below.

Think back to your time in the engineering courses you have taken so far:

- 1. Share a learning moment where you feel your course instructor sees you as a human being, not just a student, in your course.*
- 2. Share a learning moment that you feel your course instructor does not see you as a human being and just sees you as a student of the course and nothing more.*

Think back to your time in the engineering courses you have taken so far:

- 1. Share a learning moment that makes you feel like you are an active part of a community in the classroom.*
- 2. Share a learning moment that makes you feel like you are not an active part of a community in the classroom.*

I plan to analyze the open-ended responses using emergent coding (Miles et al., 2014) to allow codes and themes on “features” that marginalize minoritized communities to emerge from the analysis. The questionnaire will also provide information for me to recruit students who identify as queer for future study. Proper demographic questions based on recent research will be used for the survey (Bates et al., 2022; Westbrook & Saperstein, 2015).

I acknowledge that it is difficult to engage students in a survey or informational questionnaire, and thus the questionnaire will be completely anonymous. To address this, the demographic information questions are completely disengaged from the main survey, and future student participants are informed of this, along with the university’s Institutional Review Board (IRB) and legal team approval of the study procedures. Lastly, the goal of this study is not to generalize from a statistical standpoint. Instead, the findings from this study will provide preliminary descriptions of the “features” that marginalize, which can potentially be transferred by readers to their relevant contexts.

Positionality Statement

I am an assistant professor in an engineering department at a teaching-focused institution in the east of the United States. I identify as a cisgender, gay man who has experienced a transformed view of the world during the COVID-19 pandemic and the Black Lives Matter movement, which then shaped my current research agenda. This pilot study is the gateway for me to begin entering queer research and scholarship, with the goal of incorporating findings into my teaching practices while also sharing findings to help contribute to efforts in queering engineering education. In addition, my teaching philosophy is shaped by one premise of this study: Without having students feel comfortable being their authentic selves in the classroom, learning would be a difficult experience for the students. These positionalities inform how I have been conducting this study, and I will constantly reflect and acknowledge my preconceived notions, personal philosophies, and biases in the process.

Preliminary Findings

The informational questionnaire was administered in April and has so far gathered around 40 responses. Preliminary findings have shown that many participants mentioned several experiences that they perceived as their instructors just seeing them as student, not human being in the classrooms. These experiences include the lack of connection between the materials and applicability in the real world, offering minimal expectations and guidance for learning, instructors closing themselves off to build meaningful relationships with their students, and

stringent assessment policies that do not consider unique individual circumstances. Further analysis will be conducted to explore the features that affirm and/or devalue engineering students.

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