

WIP: Recognizing Privileges and Biases While Making Pedagogical Decisions

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Introduction

The purpose of this exploratory qualitative research paper is to investigate faculty understanding of Culturally Responsive Pedagogy (CRP) in engineering courses.

Despite decades of efforts to diversify STEM fields, women and underrepresented racial and ethnic groups remain significantly underrepresented in engineering occupations and educational pathways. According to recent national data, women continue to comprise a minority of the U.S. engineering workforce: in 2023, women held roughly 17.6% of engineering occupations overall, with Hispanic/Latina women representing approximately 1.6% and Black women approximately 0.5% of engineers, while White and Asian women comprised larger shares of engineering roles [1]. These disparities reflect broader patterns of underrepresentation in STEM: women accounted for about 35% of the overall STEM workforce in 2021, and underrepresented racial and ethnic groups (including Hispanic/Latino, Black or African American, and American Indian or Alaska Native individuals) collectively made up around 23% of STEM workers.

Underrepresentation in the workforce is mirrored in engineering degree attainment and student enrollment patterns, underscoring persistent barriers to participation in STEM at large. Such disparities contribute to ongoing inequities in the profession and highlight the need for inclusive pedagogical approaches that support students from historically marginalized backgrounds.

Research suggests that inclusive pedagogical practices—such as raising awareness of students’ social identities and addressing barriers to academic success like implicit bias, microaggressions, stereotype threat, and fixed mindset—are critical for improving equity and belonging in STEM classrooms. [2]. Faculty members’ beliefs, biases, and positionalities influence how they design courses, interact with students, and respond to classroom diversity. Without understanding faculty conceptualizations of CRP, professional development efforts may remain superficial and fail to address the deeper assumptions that shape teaching practice.

To unpack these issues, this study addresses the following research questions:

1. What are faculty understandings of Culturally Responsive Pedagogy?
2. How do those understandings influence their pedagogical approaches and implementation of Culturally Responsive Pedagogy in engineering courses?

Understanding how faculty interpret and implement Culturally Responsive Pedagogy is essential because faculty beliefs, biases, and positionalities shape the learning environments students experience and ultimately influence equity, belonging, and persistence in engineering education.

Background

Faculty members play a fundamental role in advancing inclusion in higher education. Their beliefs and instructional practices have been identified as determining factors in shaping institutional approaches to inclusion [3]. However, faculty are often trained within disciplinary cultures defined by epistemologies, theories, and methods rooted in Western norms and STEM disciplines which are highly male dominated. [4;5]. These traditions can inadvertently reinforce exclusionary assumptions about who “belongs” in a field and how knowledge is produced and valued.

Prior research [6] highlighted that microaggressions are frequently experienced by marginalized students, communicating negative, derogatory, and even hostile messages to the members of underrepresented groups. These subtle, often unintentional behaviors can manifest through faculty interactions and classroom climate and are understood as expressions of implicit bias. Microaggressions based on race/ethnicity, LGBTQ+ status, religious affiliation, ability, socioeconomic status, or other social identities contribute to environments that hinder academic success and belonging [2]

Faculty beliefs about students also significantly influence teaching and learning dynamics.

CRP emphasizes teaching practices that recognize students’ cultural identities, lived experiences, and ways of knowing as integral to learning rather than peripheral to it [7;8]. CRP challenges deficit-oriented perspectives by positioning culture as an asset and by explicitly addressing the power relations embedded in curriculum, pedagogy, and assessment. Within STEM and engineering education, culturally responsive approaches have been shown to support student engagement, belonging, and academic persistence, particularly for students from historically marginalized groups [9;10]. Central to the implementation of culturally responsive pedagogy is faculty engagement in critical self-reflection. Scholars argue that instructors must examine how their own identities, positionalities, and disciplinary socialization shape assumptions about intelligence, merit, and student capability and critical self-reflection is considered as a powerful teaching tool [11;12]. Faculty beliefs are not neutral; rather, they are shaped by broader sociocultural and institutional norms that can unintentionally reproduce inequities in the classroom [7]. Without deliberate reflection, implicit biases may influence instructional decisions, interactions with students, and interpretations of student performance [13]. Therefore, critically understanding positionalities and biases of faculty members are an integral part of implementing CRP.

Also,[14] found that instructors’ expectations and beliefs shape how they design and implement courses, communicate with students, and either support or discourage students’ academic persistence. Scholars such as [15] have argued that fixed-mindset beliefs about student ability in STEM magnify stereotype threat by signaling that ability is static and linked to social group membership. Despite growing attention to student experiences of climate and culture, much of the work on achieving inclusive classrooms has focused on students’ backgrounds and their perceptions of climate rather than on how faculty, institutional cultures, and structural inequalities interact to create environments that are difficult to navigate, especially for students from underrepresented groups.

Theoretical Framework

This study is framed by Ladson-Billings’s theory [7] of Culturally Relevant Pedagogy (CRP), which consists of three core components: academic success, cultural competence, and sociopolitical consciousness. Academic success emphasizes meaningful student learning and achievement. Cultural competence refers to helping students value their own cultural identities while gaining access to broader academic and professional spaces. Sociopolitical consciousness encourages students to recognize, critique, and challenge social inequities related to race, class, gender, and power.

Our work is framed in Ladson-Billings’s [7] framework for culturally Relevant Pedagogy which constituting three components. Culturally Relevant Pedagogy is focused on cultural competence, which

“refers to helping students to recognize and honor their own cultural beliefs and practices while acquiring access to the wider culture, where they are likely to have a chance of improving their socioeconomic status and making informed decisions about the lives they wish to lead” [16] Culturally Relevant Pedagogy seeks to develop sociopolitical consciousness among students, which includes a teacher’s obligation to find ways for “students to recognize, understand, and critique current and social inequalities” [7]. The pillar of Culturally Responsive Pedagogy is that sociopolitical consciousness begins with teachers recognizing sociopolitical issues of race, class, and gender in themselves and before then incorporating these issues in their teaching. Ladson-Billings [16] described “student learning as what it is that students actually know and are able to do as a result of pedagogical interactions with skilled teachers” (p. 34). Therefore, the framework of Culturally Responsive Pedagogy pays a lot of importance to the teacher awareness and their skill development. We extend this framework to faculty development in engineering education by focusing on how instructors’ self-awareness, positionalities, and biases shape their pedagogical decisions. Because faculty exercise significant autonomy in course design and classroom practice, their understanding of equity and inclusion directly influences how CRP is enacted in engineering classrooms.

Methodology

This study took place at a large public university in the United States and home to one of the most extensive engineering programs in the country. This University is a Hispanic Serving Institution with an undergraduate student body that is 4% Black [17]. In this study, so far we have interviewed five faculty members using a set of semi-structured questions. Participants were selected based on their teaching roles in engineering courses and their willingness to reflect on issues of inclusion, equity, and culturally responsive pedagogy in their instructional practices. Rather than aiming for statistical generalizability, this study seeks to generate deeper insight into faculty meaning-making and instructional choices, offering an important foundation for future faculty development efforts and larger-scale studies in engineering education.

The semi-structured interviews were targeted to focus on the faculty experiences with course syllabus, course content, learning climate, learner support, teaching strategies, and assessment of learning as six interrelated sections as suggested by [18]. In the future the team plans to conduct more interviews across Southern States within the USA. Also, we have specifically designed questions to understand the faculty perception of culturally responsive pedagogy and their willingness to change their approach. Each interview lasted between 60-90 minutes. The interviews were audio-video recorded with the consent of participants. As a first-cycle analysis, transcripts were coded deductively. Data analysis were conducted in three stages, including inductive coding, the development of a codebook, and pattern coding [19]. To ensure the accuracy of the data, member checking and intercoder reliability were implemented.

Interview Question

What does “Culturally Responsive Teaching” mean to you?

Interview Question

What experiences have you had that have helped you understand the impact of race, culture, and ethnicity on teaching and learning in the context of your teaching?

How do you encourage your students to be respectful of other students and their perspectives?

How do you foster collaboration among your students? What changes, if any, do you make to the physical classroom environment to help facilitate collaboration?

Do you believe STEM instructors should be more inclusive? If so, in what ways?

Please describe a teaching and learning activity you have implemented in your classroom with the intention of engaging students from underrepresented groups in engineering (e.g., Black, Latino, international, or female students).

Table 1: Examples of Interview Questions

Tentative Findings

Our initial findings suggest that engineering faculty demonstrate varying levels of understanding of Culturally Responsive Pedagogy (CRP), and that their implementation of CRP is shaped by their positionalities, professional socialization, and implicit biases. Faculty participants approached inclusive teaching through markedly different lenses, ranging from color-blind and gender-blind, performance-driven approaches to more reflective, student-centered practices. These differences highlight how faculty beliefs and identities influence the enactment of CRP in engineering classrooms.

Performance Driven Approach

Some faculty, particularly those from more privileged backgrounds, prioritized performance and technical mastery while minimizing the role of race, gender, and intersectionality in their teaching. These instructors often described CRP as including global perspectives or providing flexible choices rather than engaging with power or inequity. Several faculties reporting that they intervened mainly when students struggled academically. One faculty member explained:

Do I give students different amounts of attention based off of how comfortable they might be in class or how well they perform? Yes... You could have a Black student that's performing wonderfully in class and a White student not doing well. I'm probably going to give more of my attention to the White student... I'm trying to do my job to create an environment where everybody feels supported... If there is some correlation between race or gender or whatever, then maybe I need to consider something else... But I don't really have those data.

This perspective reflects a reliance on perceived neutrality and performance-based decision-making rather than equity-oriented analysis.

When asked whether they intentionally designed activities to engage marginalized students, another faculty member stated:

When I was a student, I didn't like some faculty because I would be the only woman... and they would almost give me more attention than anyone else... that doesn't feel caring necessarily. I try not to bring extra attention to people because they look different in my classroom.

Although framed as fairness, this approach limited opportunities to acknowledge differential experiences or structural barriers.

Fostering Reflective Practices

In contrast, some faculty demonstrated more reflective practices, intentionally incorporating students' voices and social contexts into instruction. One instructor teaching a sophomore design course emphasized stakeholder perspectives through role-play, with students alternating between roles as engineers and stakeholders. In the same course, students either formed teams based on shared values or were assigned teams using a structured survey, depending on the instructor. These faculty explicitly discussed how race, gender, and nationality could influence design decisions. Some faculty also reflected on their teaching during interviews and generated new ideas in real time. One instructor shared:

Just as you and I are talking, I'm recognizing this dichotomy... in design classes it's getting to be more and more pervasive. I don't know how well it's done.

She went on to propose changes to a manufacturing course to address the absence of race and gender discussions:

But I am going to make them find a list of people who did something, and maybe non-white males or women in women. Yeah, non-white males that's what I mean it could be a white woman or a black man or a black woman or just not a white man anybody that's not a white man and i'll make them research them to write a couple pages about what they how they contributed to, i'll think of some. Some ways to make them push them to start thinking about.

These findings suggest that faculty understanding of CRP exists along a continuum rather than as a fixed category. Faculty who relied primarily on performance-based notions of fairness often overlooked structural inequities, while those engaging in critical self-reflection demonstrated stronger alignment with culturally responsive teaching practices. This continuum highlights the importance of faculty development that moves beyond general inclusion efforts toward deeper examination of privilege, bias, and instructional decision-making.

	Gender	Race	Nationality	Courses Taught	Familiarity with CRP	Adaptation of CRP
Faculty 1	M	White	USA	Use-Inspired Design, Materials and Manufacturing Process, Applications of Quantitative Methods for Engineering Education Research	Yes	Yes
Faculty 2	F	African American	USA	Use-Inspired Design, Inclusion and Equity, Qualitative research	Yes	Yes
Faculty 3	F	White	USA	Engineering Mechanics, Thermodynamics, Quantitative Methods, Entrepreneurship	Yes	No
Faculty 4	M	Asian	USA (International Background)	Use Inspired Design, Next Generation Sustainability Governance, Fluid Dynamics, Politics of Science and Engineering , Climate Change Energy and Social Justice	No	No
Faculty 5	F	White	USA	Modeling of Manufacturing System, Simulating Manufacturing Systems, Use Inspired Design, Quantitative methods	Yes	Yes

Table 2: Details of the faculty participants

Significance

This study advances scholarship on the adaptation and implementation of culturally responsive pedagogy (CRP) in college-level engineering coursework. While multiple federal initiatives and institutional policies have sought to broaden participation and increase inclusion in STEM, comparatively little is known about how engineering faculty members' understanding, beliefs, and attitudes toward CRP shape their instructional decisions and the extent to which they adopt culturally responsive practices. Prior efforts have largely emphasized generic diversity, equity, and inclusion (DEI) trainings; however, such approaches are limited in effectiveness without a nuanced understanding of faculty beliefs, positionalities, and interpretations of CRP. By centering faculty meaning making, this study has the potential to inform more intentional, contextually grounded approaches to DEI implementation on campus.

This work also contributes to the research-to-practice cycle by informing faculty development efforts. Findings from this study can support ongoing faculty development conversations and planning, particularly as institutions seek to respond to emergent interests in inclusive teaching across disciplines. As such, the study is positioned to influence both current faculty practices and future faculty development models within and beyond engineering education.

STEM core courses are often high-enrollment and taught by multiple instructors, yet marginalized student groups continue to experience lower participation and graduation rates in these fields. Improving student experiences in these foundational courses may foster more positive perceptions of STEM majors and

strengthen students' sense of belonging and persistence. The results of this study may therefore contribute to increased participation and graduation rates among historically marginalized students.

We acknowledge that this pilot study targets a smaller sample size ($n = 5$) and is situated within a single institution so far. However, we contend that this work provides a critical foundation for unpacking how engineering faculty understand and engage with CRP. Also, by illuminating how privilege and bias shape instructional decision-making while implementing CRP, this study lays the groundwork for future, larger-scale research and targeted interventions aimed at supporting faculty in transforming their pedagogical practices.

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