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# WIP: Factors Influencing Faculty Pedagogical Decisions around Diversity, Equity, Inclusion, and Justice (DEIJ) in Engineering: A Comparative Case Study

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# Factors Influencing Faculty Pedagogical Decisions around Diversity, Equity, Inclusion, and Justice (DEIJ) in Engineering: A Comparative Case Study

## Introduction

Integrating Diversity, Equity, Inclusion, and Justice (DEIJ) into engineering education is increasingly recognized as essential for fostering transformative change. By highlighting the social and political dimensions of engineering practice and design, DEIJ initiatives address longstanding challenges in the field. Scholars have recently prioritized embedding social issues across various curricular contexts [1] - [3], underpinned by research that demonstrates how inclusive curricula enhance students' comprehension of engineering problems by situating them within real-world contexts [4]. Additionally, accreditation bodies have underscored the importance of preparing future engineers to tackle issues of prejudice, racism, and discrimination in their professional careers [5], [6]. Despite this increased focus, integrating DEIJ content into engineering curricula remains a significant pedagogical challenge. This difficulty arises from a complex array of influences and contextual factors, such as faculty personal beliefs and experiences about teaching and learning [7], beliefs on student achievement and ability [8], specific job responsibilities and departmental culture [9], and their course- or discipline-specific priorities and needs [10], [11]. Moreover, perspectives and conceptions of equity greatly influence their teaching practices in STEM and how faculty view themselves promoting equity, with many faculty members feeling unprepared to effectively teach DEIJ topics [12] - [15]. However, the specific mechanisms through which these influences shape classroom practices remain insufficiently understood.

There is a pressing need to examine how engineering faculty thoughtfully engage in the complex decision-making process of integrating DEIJ content into their curricular and pedagogical practices, especially as they are increasingly recognized as key actors who must actively seek opportunities to deepen their understanding of diversity, equity, inclusion, and justice in engineering courses [16]. Curricular practices refer to the content, objectives, and structure of what students are expected to learn, encompassing the knowledge and skills to be acquired [10]. Pedagogical practices, on the other hand, involve the methods and strategies educators use to teach and engage students, focusing on the delivery and facilitation of learning [10]. This qualitative research explores how national, institutional, and disciplinary influences, alongside faculty values, beliefs, and experiences, shape decisions regarding incorporating DEIJ content into engineering education. By bridging individual beliefs and structural factors across diverse settings in U.S. engineering programs, this study seeks to identify the mechanisms through which they affect classroom practices, thereby promoting equitable teaching. The research is guided by three broad questions:

1) What are engineering faculty's past and current experiences with incorporating and teaching DEIJ-focused content within engineering courses and curricula?
2) How do engineering faculty conceptualize the relationship between incorporating and teaching DEIJ-focused content and racial and educational equity goals in engineering education?

3) What pedagogical decisions do engineering faculty make about course design, instruction, and content surrounding DEIJ in engineering within contemporary U.S. society?

This work-in-progress paper reports the progress of an ongoing qualitative, Comparative Case Study (CCS) exploring engineering faculty experiences and pedagogical decisions around DEIJ, which is currently in the data analysis phase. This paper focuses on the methodological foundation of this CCS and overviews: (1) the conceptual framework; (2) research methodology and activities; and (3) analysis procedures and preliminary observations of the data; and (4) directions for future work.

## Conceptual Framework

This research draws on two complementary frameworks—the Academic Plan Model (APM) described by Lattuca and Stark [10] and the White Racial Consciousness/Faculty Behavior Model (WRC/FB) presented by Haynes [13], [17]—to examine the complex factors influencing faculty decision-making in engineering education. The APM situates faculty decisions within the broader context of institutional and departmental policies and practices, while the WRC/FB model complements this by focusing on how racial awareness and consciousness, shaped by these contexts, influence faculty behavior. Together, these frameworks integrate personal beliefs with structural influences, establishing a comprehensive lens for examining how various intersecting factors—including sociocultural, organizational, departmental, disciplinary, and personal elements—shape faculty pedagogical decision-making in engineering education.

First, The APM offers a multi-level perspective on curriculum, recognizing it as both a cultural product shaped by larger sociocultural and institutional contexts, and a blueprint for fostering student learning and development, encompassing decisions about purpose, content, instructional processes, and resources. I draw on the APM to examine how various factors, such as faculty knowledge, social contexts, teaching experience, and institutional culture, influence pedagogical choices [10]. Faculty pedagogical decision-making in engineering is influenced by a range of intersecting factors, including personal beliefs and experiences about teaching and learning [7], [18], perceptions of student achievement and ability [8], specific job responsibilities and departmental culture [9], and their course- or discipline-specific priorities and needs [10], [11]. The APM has been widely used to examine these influences, with studies focusing on aspects such as the inclusion of diversity content in curricula [11], the alignment of teaching methods with continuous improvement principles [19], faculty decision-making in teaching and learning [20], and the impact of personal and environmental factors on faculty perspectives regarding ethics and societal impacts [21]. These studies highlight how both internal factors (e.g., departmental culture, peer faculty, institutional missions) and external factors (e.g., accreditation agencies, professional societies, industry, and government) shape the educational environment and instructional practices in engineering education.

Second, this research draws on the WRC/FB [13], [17], [22] to complement the APM by focusing on how engineering faculty members' racial consciousness influences their equity-oriented practices. It highlights how systems of power and privilege, rooted in white supremacy, shape societal, cultural, and institutional structures [23] - [25]. This model links faculty pedagogical decisions to their levels of racial consciousness, suggesting that those with race-neutral or color-evasive ideologies may be less likely to address structural inequities, promote equitable educational outcomes or integrate DEIJ content into their curricula [14], [15]. The WRC/FB model emphasizes that racial consciousness is crucial for shaping pedagogical practices and engagement with DEIJ initiatives, as both White and non-White faculty can unintentionally perpetuate whiteness in their professional practices [26]. It highlights that personal beliefs, values, and race-related experiences significantly impact faculty decisions about DEIJ content. Furthermore, the model suggests that power structures in educational settings, such as classrooms, can reinforce racial superiority by promoting white racial knowledge and downplaying racial hierarchies [27] - [29].

As informed by the WRC/FB model, faculty perspectives on equity significantly impact teaching practices in STEM fields, including engineering [12], [30]. Internal factors such as student resistance and race-neutral attitudes can impede the adoption of DEIJ content in technical courses, and while some faculty strive to implement inclusive practices, many struggle to acknowledge racialized events and feel unprepared to effectively teach DEIJ topics [4], [12] - [15], [30]. Understanding these challenges is crucial for promoting equitable teaching practices and supporting faculty in fostering inclusive environments, as they play a significant role in shaping learning opportunity structures—such as policies, practices, and norms—that impact students' academic pathways and outcomes in higher education [16], [31] - [34]. To explore these dynamics, this research integrates the APM and the WRC/FB model. The APM offers a structural view of the broader educational context, highlighting how institutional policies and practices influence pedagogical choices. While the WRC/FB model focuses on the sociocultural contexts that shape individual faculty perspectives, emphasizing the role of racial consciousness and the impact of power structures in educational settings. By combining these frameworks, this study examines how intersecting factors—including sociocultural, organizational, departmental, disciplinary, and personal elements—affect faculty decision-making around DEIJ in engineering education.

## Research Methodology and Activities

This study draws on Comparative Case Study (CCS) theory and methodology [35], [36] to explore how engineering faculty make decisions about whether and how to adopt DEIJ content in engineering courses. CCS is an approach to qualitative case study research that examines how phenomena evolve across contexts and scales over time, offering an alternative to case study methodologies, which often “bound” cases within fixed locations and overlook evolving cultural dynamics [37] - [39] . Instead, CCS conceptualizes culture and context as dynamic, relational, and spatial—viewing culture as an evolving sense-making process shaped by historical, socio-political, and power-laden forces rather than a static set of group-specific behaviors [35], [36].

The CCS approach employs two key comparative logics: the “compare and contrast” approach and a relational logic that traces connections across sites and scales [35], [36]. CCS assembles cases through the theoretical constructs guiding the inquiry instead of relying on discrete empirical units such as individuals, organizations, or departments–prioritizing theoretical relevance over isolated, empirical observation [35], [36]. Using three comparative axes—horizontal, vertical, and transverse—CCS guides researchers to situate each "case" within broader networks of social, cultural, political, and economic influences [35], [36].

First, the horizontal axis in CCS examines how similar phenomena manifest differently across socially produced locations, emphasizing the influence of local contexts, relationships, and material conditions on practices and policies [35], [36]. In this study, the horizontal axis explores how departmental, institutional, and disciplinary contexts shape faculty experiences with DEIJ, as well as faculty integration of DEIJ into curricular and pedagogical practices. For example, horizontal comparisons emphasize how faculty in different engineering disciplines—such as mechanical, civil, and chemical engineering—design course content to address societal inequities and use varied teaching methods, like project-based learning or group work, to foster inclusive learning environments.

Second, the vertical axis in CCS examines how power dynamics, policies, and hierarchical structures across socially produced scales—from local to global—shape educational practices and outcomes [35], [36]. In this study, the vertical axis explores how multi-level influences, such as departmental initiatives, institutional policies, and broader societal trends, impact faculty decisions regarding DEIJ in curriculum and pedagogy. For example, vertical comparisons draw attention to how actors at various levels—such as individual faculty, departments, and national policy bodies—respond to and implement DEIJ-related mandates and curricular change policies, revealing the interplay between external and internal factors and faculty agency.

Finally, the transverse axis in CCS traces how historical trajectories and temporal changes intersect with the horizontal and vertical axes [35], [36], revealing how past events, structural legacies, and sociopolitical shifts shape and contextualize present and future practices and policies. In this study, the transverse axis explores how historical injustices, such as pervasive racial and educational inequities, continue to influence contemporary educational landscapes and faculty practices in engineering [35], [40] - [43]. Transverse comparisons highlight how events like the Black Lives Matter movement and the COVID-19 pandemic have shaped DEIJ-related policies and faculty approaches to curriculum and pedagogy, underscoring the enduring impact of historical and sociopolitical contexts. Together, these three comparative axes provide a multidimensional framework for understanding the complex interplay of local, structural, and historical factors, enabling CCS researchers to produce rich, nuanced analysis of dynamic, multi-sited phenomena [35], [36].

### ***Data collection***

The data collection for this CCS entailed a combination of purposeful, convenience, and snowball sampling methods. Inclusion criteria for the study sample included U.S. engineering faculty actively teaching (e.g., tenure-track, contingency). Faculty were asked to participate in three components: a) an Electronic Survey, (b) an Interview (up to 75 minutes), and (c) an Optional member-checking interview (i.e., upcoming following the data analysis phase). Recruitment activities were dynamic and responsive as the study progressed and included (a) leveraging personal and professional networks, (b) obtaining faculty participant referrals, (c) electronic advertising in various venues (i.e., ASEE division listservs, faculty development consulting groups), and (d) direct outreach to individual departments and faculty members. These activities resulted in a final sample of 36 faculty representing a range of contextual factors, including coming from 15 states, representing 18 institutions, various institutional types (e.g., land grants, Hispanic-serving institutions), and engineering departments/disciplines. Faculty participants carry various appointments and roles, ranging from adjunct to full professor, lecturers and teaching faculty, department head/chairs, and those who held previous administrative roles (e.g., center directors, provost).

Interviews were conducted in-person and virtually (e.g., via Zoom), resulting in over 36 hours of primary interview data, and transcribed, reviewed for accuracy, and de-identified to maintain participant confidentiality and accurately represent faculty experiences [44]. The interview protocol draws on DEIJ literature in engineering education and leverages theoretical constructs of the APM and WRC/FB frameworks and prompts engineering faculty to consider and discuss various dimensions of their experiences, motivations, and practices related to DEIJ. These dimensions include: (i) their conceptions of DEIJ and its relevance to engineering; (ii) opportunities and challenges in integrating DEIJ into teaching practices and professional responsibilities; (iii) their pedagogical approaches and decision-making processes; (iv) and the influence of institutional structures—such as professional development opportunities, incentives, and organizational support—influence on pedagogical choices. The protocol also explores how recent socio-historical events, like COVID-19 and the Black Lives Matter movement, impact and shape faculty perspectives and practices.

In addition to interviews, this study utilizes three additional data sources. First, during the consent process, faculty participants provided information about their demographics, years of experience, recognition for teaching, research, and service, courses taught over the past five years, and relevant faculty support systems they accessed. Second, some faculty participants provided supplemental documents to enrich the interview data, including their academic CVs, teaching and diversity statements, course and lab syllabi, peer observations and teaching award applications, class examples and presentations, and conference presentations on educational research. Finally, data from publicly available sources across the 18 participating institutions is actively being collected. These include institutional, departmental, and faculty-related information such as publications on DEIJ efforts and activities, plans of study, curriculum committee reports, institutional diversity statistics and reports, department newsletters, CVs and research activities, and faculty handbooks and annual reports. These diverse data sources allow for a comprehensive analysis that engages with the horizontal, vertical, and transverse axes of comparison to (a) understand how engineering faculty perceive and frame their pedagogical experiences around DEIJ and (b) account for the various historical, cultural, social, and political contexts influencing their pedagogical decisions.

***Analytic Framework***

The goal of analysis in the CCS is to engage with the three comparative axes to explore faculty experiences related to DEIJ, construct analytic themes around the influences on faculty pedagogical decisions and perspectives, and compare these experiences across various contextual factors. To achieve these objectives and ensure the reliability and validity of the findings [35], [39], [45], this CCS employs an analytic framework that employs multiple data analysis methods. This framework, detailed in Table 1, consists of four analytic cycles and draws on inductive and deductive methods, as well as thematic and content analysis techniques such as immersive engagement, cyclic coding, and theme development [46] - [48]. This approach begins with faculty as individual cases and then analyzes across the comparative axes to uncover the development of diverse contexts and cultural processes in faculty curricular and pedagogical practices while considering the dynamic, spatial, and relational interplay of sociopolitical and institutional factors.

For the inductive analysis (i.e., Cycles 1, 3, 4), interview notes, transcripts, and data sources were reviewed to generate semantic codes based on participants' exact words (i.e., in vivo coding) [47], [48], ensuring data alignment and capturing faculty narratives and perspectives on DEIJ and the influences of various actors, institutions, and policies. The resulting codebook condensed data, identified patterns, developed themes, and facilitated dialogue among faculty from diverse backgrounds. In the deductive analysis (Cycles 2 and 4), elements from the conceptual framework (e.g., APM, WRC/FB), research questions, and existing literature were applied to deductively code the data [47], [48], examining how academic strategies influence pedagogical choices and how faculty racial consciousness affects equity-oriented practices. Deductive codes focus on topics such as faculty experiences, motivations, beliefs on equity, DEIJ integration, institutional priorities, systemic inequities, DEIJ adoption, faculty mindsets, and the culture of engineering education.

Throughout the analysis, memos capture researcher's initial thoughts, connecting themes to the conceptual framework, reflections on research goals, methodological decisions, and consultations with advisors and experts in engineering education research (EER) [47], [48]. These memos also document researcher-identified noteworthy moments, such as instances such as instances of faculty using racialized language or expressing emotional responses, highlighting the researcher's role in the analytical process. This reflexive practice helps identify and address potential biases, refine analytical strategies, and ensure alignment between research questions, data collection and identified patterns [47], [48]. Regular discussions with advisors and multiple rounds of coding and triangulation enhance the credibility and validity of findings [35], [39], [47], [48].

TABLE I

OVERVIEW OF ANALYTIC CYCLES

| Cycle | Activity |
|---|---|
| Cycle 1 | **Inductive analysis:** Open coding and in vivo coding (identify emergent concepts, ideas, identifying patterns across codes), Axial/analytic coding<br>**Memos:** To capture initial impressions of data, and to develop code definitions, identify key questions in relation to RQ or other dimensions.<br>**Product:** Inductive codes (Grouping codes into broader categories) |
| Cycle 2 | **Deductive analysis:** Categories developed from central constructs in the RQ,<br>**Memos:** Form and record initial impressions of the data in relation to the RQ<br>**Product:** Sort data into broad categories relevant to RQ (key topics) |
| Cycle 3 | **Inductive analysis:** Pattern coding, theme development (condense inductive codes develop patterns and then themes, then work towards findings).<br>**Memos:** Preliminary responses to RQ, develop case summaries, catalog changes.<br>**Product:** Preliminary findings of inductive analysis |
| Cycle 4 | **Deductive and inductive analysis:** theoretical coding.<br>**Function:** Apply theoretical framework to the data and use it to explain findings.<br>**Memo:** Responding to analytic questions about data related to research and frameworks and to develop explanations of findings.<br>**Product:** Theory based explanation of findings |

## Conclusion and Future Work

This research investigates how engineering faculty integrate DEIJ content into their curricular and pedagogical practices within diverse social, cultural, political, and academic contexts. Despite growing efforts to embed DEIJ in engineering education, challenges persist due to faculty beliefs, departmental cultures, and institutional or policy constraints. As central agents of change, faculty must navigate tensions between personal beliefs, institutional expectations, and broader sociopolitical pressures to promote DEIJ in their pedagogical and curricular practices effectively. By exploring these dynamics across U.S. engineering programs, this comparative case study offers insights into strategies for effectively integrating DEIJ content and promoting equity-oriented teaching practices.

While data analysis is still in progress, an initial review, reflection, and immersion in the data reveal a complex interplay of influences shaping faculty decisions, including: (1) conceptions and perspectives on DEIJ; (2) professional and personal experiences, such as DEIJ-related research, training, and workload constraints; (3) emerging roles and structures, such as departmental leadership, instructional resources, and opportunity structures; (4) pedagogical beliefs and practices, including Universal Design for Learning and collaborative approaches; and (5) institutional factors like diversity missions, existing DEI initiatives, and governance structures. These insights illuminate a range of interconnected factors shaping faculty engagement with DEIJ and highlight potential opportunities to address systemic barriers. Future work will provide a comprehensive analysis of these dynamics and propose actionable recommendations to advance the development of targeted programs, policies, and practices that support faculty in overcoming barriers to DEIJ integration across engineering.

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