Board 397: Sustainable Racial Equity: Creating a New Generation of Engineering Education DEI Leaders

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Sustainable Racial Equity: Creating a New Generation of Engineering Education DEI Leaders

Abstract

In this paper, we report updates on the first phase of an NSF-funded project focused on understanding how to better prepare a new generation of engineering leaders to face the complexities of diversity, equity, and inclusion (DEI) in the field. This project aims to advance our understanding of the experiences, educational training, decision-making, and research that support the development of influential engineering education leaders assuming roles focused on diversity, equity, and inclusion (DEI). These roles include but are not limited to DEI University committee service, national organizations focused on racial equity and improving conditions for traditionally marginalized populations, DEI administrative roles in higher education, DEI advisory roles in funded projects, and DEI consulting work. Despite efforts to broaden participation and make engineering more equitable and inclusive, we still fall short of attracting and retaining students and faculty members from traditionally marginalized populations, especially at large engineering institutions. Part of the problem is that DEI initiatives, programs, and research lack solid institutional commitment and policies. The project's first phase involved conducting a literature review to understand how DEI has been theorized in engineering education. Based on those theories, we developed an interview protocol to explore DEI leaders' experiences, knowledge, and decision-making processes. Additionally, we outline the development of criteria for selecting our interview participants and the various roles identified.

Introduction

In the field of engineering education and beyond, diversity, equity, and inclusion have garnered increased attention over the recent decades [1], [2], [3]. Engineering fundamentally revolves around tackling intricate challenges, and developing long-term solutions to societal problems. Yet, the effectiveness of these solutions greatly hinges on their ability to encompass a spectrum of perspectives, experiences, and skills from the global community. It falls upon engineering educators to foster inclusive environments where every voice matters, diversity is celebrated as a driver of creativity, and fairness guarantees equal access to opportunities for everyone. However, despite efforts to broaden participation and make engineering more equitable and inclusive, we still fall short of attracting and retaining students and faculty members from traditionally marginalized populations [4], [5]. Part of the problem is that DEI initiatives, programs, and research are not supported by strong, long-term institutional commitment and policies. Several research and funding have been provided in this space, yet the desired impact has often remained elusive.

One significant factor contributing to this issue is the remaining systemic barriers and inherent prejudices embedded within higher educational systems. Persistent structural inequities impede the complete engagement and progression of historically marginalized students in engineering. Systemic issues can affect different aspects of the engineering education ecosystem, from recruitment to retention and graduation rates, to career prospects, workforce, and leadership. Typically, research has centered on recruitment and retention, and there remains a scarcity of studies delving into decision-making processes of leaders within these contexts. Moreover, when

focusing on attracting minoritized students and faculty members into engineering programs and institutions, several initiatives focus on improving numbers and representation. Although diversity is important, diversity without inclusion is insufficient. Increasing numbers and representation might not have a positive impact on equitable outcomes or in providing spaces that are adequate for these populations. Inclusive practices are essential to create environments where individuals from all backgrounds feel valued, respected, and empowered to contribute their unique perspectives. In the absence of deliberate actions to dismantle exclusionary practices and nurture inclusivity, diversity initiatives run the risk of merely symbolizing surface-level gestures instead of serving as drivers for enduring transformation [6].

In addition to these complexities, people at the front of making decisions or generating policies for change come from different backgrounds and experiences. Furthermore, when leaders are making decisions and assuming leadership roles, or when simply faculty members are acting as agents of change, many of the times they have not been prepared or equipped to assume these roles, and most of their work takes an emotional toll on them [7], [8].

It becomes evident of the need to continue expanding our understanding of DEI's transformative potential in engineering education. Engineering educators must undergo continuous education and training to deepen their understanding of DEI issues and develop inclusive research, mentoring, and pedagogical practices. The following section presents the overview of the larger research project and its aims.

NSF CAREER Project: Sustainable Racial Equity: Creating a New Generation of Engineering Education DEI Leaders

This project aims to advance racial equity in STEM education by exploring the beliefs, experiences, educational training, and research that support the development of influential engineering education leaders assuming roles focused on DEI. Accordingly, this project's primary objectives are to 1) understand DEI leaders' perceptions, knowledge, and challenges around their roles; 2) examine the extent to which those perceptions compare and contrast with traditionally marginalized graduate students and early career faculty members; and 3) develop training and faculty development programs to prepare the next generation of DEI leaders.

As mentioned, DEI initiatives are not yet entirely successful in promoting racial equity. The focus is on DEI leaders for two reasons. First, strong institutional commitment and policies do not support most DEI initiatives, programs, and research. There is a lack of support because of misconceptions in the understanding of the impact and the benefits that DEI work can have in institutions in the long term, making DEI work difficult and frustrating, especially for people who are part of the marginalized communities. Second, faculty members from traditionally marginalized backgrounds usually assume these roles as part of tokenism. They often do not have the adequate preparation or training to assume these roles, and there is an assumption that because of their lived experiences, they are ready to promote change and implement effective DEI interventions. Hence, these leaders provide unique knowledge that can impact our understanding of how to advance racial equity in engineering ([9], [10], [11]).

The study has 3 phases. Phase 1 uses an embedded multi-case study approach to examine the beliefs, perceptions, knowledge, and challenges of those in DEI roles. Phase 2 uses a survey methodology to extend beyond DEI leaders and explore DEI perceptions and understanding in traditionally marginalized graduate students and early career faculty members (e.g., African American, Latinx, Indigenous, members of the LGBTQ community, etc.) in engineering across the country. The survey instrument will be informed by Phase 1 results and will enable the development of training models. Phase 3 will consist of training initiatives in two parts. The first part will focus on implementing some of the models into the curriculum with the purpose of reaching graduate students in engineering. Part 2 will focus on developing training and faculty development programs to train engineering educators to be aware of DEI issues and provide them with tools to assume DEI roles and responsibilities.

In terms of research questions, the overarching question guiding the research plan is: How can we prepare the next generation of DEI leaders to implement effective, sustainable, long-term DEI initiatives? The project has the following sub-questions:

RQ1. How do Engineering Education DEI Leaders navigate their roles?
RQ2. How do traditionally marginalized engineering graduate students understand their preparation to face DEI challenges?
RQ3. How do traditionally marginalized early career engineering faculty members understand their preparation to face DEI challenges?

Table 1 – Research Plan Overview

	Phase 1	*Phase 2*
Research Questions	*How can we prepare the next generation of DEI leaders to implement effective, sustainable, long-term DEI initiatives?*	
	How do Engineering Education DEI Leaders navigate their roles? (RQ1)	How do engineering graduate students understand their preparation to face DEI challenges? (RQ2) How do engineering faculty members understand their preparation to face DEI challenges? (RQ3)
Research Design	Embedded Multi-Case Study	National Survey
Data Collection	Interviews, Documents, Observations	Questionnaire Responses
Data Analysis	Thematic Analysis	Descriptive statistics, Inferential statistics
Outcomes	1. Conceptual models of preparation for DEI sustainable implementation 2. Key areas for improvement around racial equity in engineering 3. Knowledge about barriers graduate students and faculty members have to face DEI issues 4. Policy and practice recommendations	

A multi-case study approach [12], [13] will be used to answer these questions. In qualitative research, a multi case study is an in-depth inquiry of a bounded system that contains more than

one sub-unit of analysis based on the collection of data from various sources [14]. Multi-case studies seek an understanding of larger phenomena by focusing on specific examples. We want to understand how DEI leaders in engineering education have navigated their roles; hence, it is important to understand the phenomenon as it is explored across different contexts. Table 1 provides an overview of the research plan. The following section presents an overview of the project's outcomes so far.

Phase 1 Overview – Results of the literature review and participant selection

The first stage of the research was to conduct a scoping review of the literature. The goal was to understand better the contexts, research methods, and theories regarding how research in DEI has been conducted in engineering education. Preliminary results of the scoping review can be found in Cao et al. [15]. The review provided a first understanding of the landscape of DEI research in engineering education. The overarching questions for the review were (i) In what contexts have DEI issues been elaborated on in Engineering Education? (ii) Which methods have been employed in DEI literature? and (iii) which theories have been utilized in DEI research? Using an inclusive search strategy, we retrieved 233 items mentioning DEI and engineering education. We identified 128 articles on engineering education and DEI through abstract screening and full-text sifting. We obtained an overview of the contexts, research approaches, and theoretical frameworks in DEI research in engineering education. We consider it important to understand how DEI has been theorized in the literature of engineering education research because it can help us frame our interview protocol to be used with DEI leaders.

The scoping review results provide 5 theoretical spaces in which DEI work has been conducted in engineering education research: Institutional and Organizational Theory, Social Identity and Intersectionality Theory, Critical Theory, Community and Cultural Theory, *and Constructivist and Developmental Theory.* Figure 1 summarizes the representation of each theoretical group in our search.

From the theme count, the most common theme was social identity and intersectionality theory. The most common theories discussed in this theme were social identity theory, self-efficacy and Expectancy Value Theory (EVT), Intersectionality, and Professional identity development. These theories have been discussed several times to promote DEI in Engineering Education.

Development of Interview Protocol

Results from the scoping review provided input for developing our interview protocol. Interviews are being conducted with engineering education DEI leaders representing various roles to understand their perceptions, knowledge, barriers, and preparation for the role. Informed by my theoretical foundations, the semi-structured interview protocol [16] is designed to capture the DEI leader's stories of preparation for the role and successful implementation of DEI initiatives, which will inform what we know about DEI issues in engineering. Because this research method does not have a prescribed sampling technique, We are using a combination of quota and maximum variation sampling approaches [17].

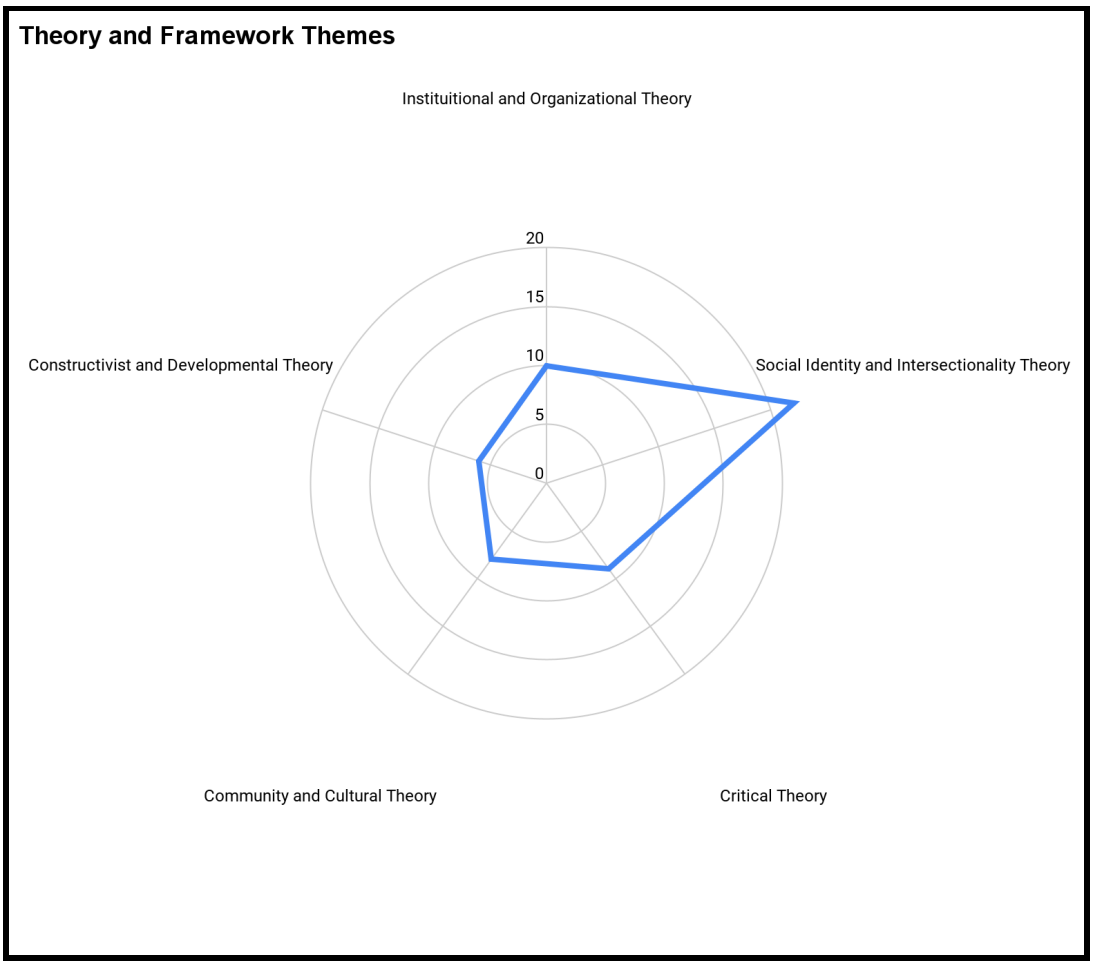

Figure 1. Emerging themes from the scoping review

Quota sampling allows us to ensure coverage of the different roles of DEI leaders in our sampling frame. Maximum variation sampling will enable us to explore various roles and contexts within each subpopulation purposely. One interesting aspect of this research has been the identification of participants. We realized that identifying DEI leaders internationally, including various perspectives, is not easy. So far, we have identified the following categories of participants:

1. Formal DEI leader—institutional level: Individuals who have a formal role at an institution (universities, national organizations, government) dedicated to DEI issues, such as the Associate Vice Provost for Inclusive Excellence.
2. Formal DEI leader – college level: Individuals with a formal role at higher education institutions dedicated to DEI issues at the college of engineering level. For example, Associate Dean for Diversity, Equity, and Inclusion at the College of Engineering.
3. Service leader: Individuals who have roles in service where they lead DEI initiatives, such as the Department of Engineering DEI chair. Often, this role is conducted as part of the individual service, and their main role usually focuses on something else (e.g., teaching or research).

4. Independent leader: Individuals that are dedicated to do consulting, training, or evaluation of DEI issues. Usually, these individuals are entrepreneurs with their own firms dedicated to these purposes.
5. Leaders in DEI-focused organizations: Individuals who have leadership roles at organizations whose mission is to improve DEI issues in engineering (e.g., SHEP, NSBE)
6. Informal leaders: individuals who do not have a formal DEI role; however, they have been recognized as DEI influencers and leaders because of their work and ability to stand up for causes around DEI; they are usually mentors, speakers, or influencers in this space.
7. Research leaders: Individuals that do not have a formal DEI role; however, their research focuses on broadening participation, understanding systemic barriers, or overall improving the DEI status in engineering education; these leaders have accomplished lots of initiatives as a consequence and an impact of their research.

The interviews will facilitate understanding the experiences of DEI leaders in a unique way, allowing us to identify challenges and strategies that are not easy to describe otherwise. We will examine how a DEI leader explains, rationalizes, and articulates their decision-making and expectations around how ready they were to assume their DEI roles and how has the life-long learning process around the role evolved. The interviews will be analyzed using an inductive qualitative coding process [18]. First, we will look for aspects of the participants that pertain to how they describe, explain, and predict the state, form, function, and purpose of DEI initiatives and knowledge. This coding process lends itself to a subsequent thematic analysis [19] by coding the interviews to find emerging themes and, achieving consistency and ensuring research quality [20], [21].

In addition to interviews, following case study methodologies [12], and additional source of information is required to better understand the phenomenon of study. We plan to conduct an analysis of different documents that work as interrelated elements dictated by a governing institution or organization that often inform acceptable ways of knowing, doing, and being. In practice, these documents include *explicit policies*, *DEI initiatives and programs*, *and website information*. We will examine the extent to which these documents align with DEI leaders' reported behaviors, knowledge, and decisions. We will initiate this process by focusing on policy documents. These documents are comprehensive artifacts that illustrate what is important to a context. They provide contextual information that has been negotiated, accepted, and consumed as the norm within that context [22].

Future Work

The next phase of the study will involve a survey of traditionally marginalized graduate students and early career faculty members in engineering across the United States. This phase will build upon the results from Phase 1. Findings in the preceding qualitative phase will inform the survey questions. The goal here is to expand the initial conceptions and understanding of DEI to contrast and compare to perceptions of traditionally marginalized graduate students and early career faculty members to identify (i) how DEI issues are perceived, (ii) how competent they are to face DEI issues and challenges, (iii) what are their DEI training expectations, and (iv) understand their support systems to face DEI issues. That expansion will enable the identification of systematic patterns in DEI knowledge and enacted practices of racial equity in engineering.

Finally, the last phase will be developing an education plan that better equips engineering graduate students and early career faculty members to understand the importance of DEI issues and have tools to empower and support the development of marginalized students. To accomplish this goal, the education plan is divided into two parts: one focused on traditional courses and the other on training and faculty development programs.

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