BOARD # 332: CAREER BPE: A Critical Collaborative Ethnography to Center Racial Equity in Engineering Education Research and Practice

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Dr. Halkiyo is a Postdoctoral Associate at the School of Universal Computing, Construction, and Engineering Education at Florida International University. Dr. Halkiyo graduated in Education Policy and Evaluation from Arizona State University and uses mixed methods but largely qualitative inquiry to study his primary research interest: enhancing higher education equity for all students, particularly those from international and/or underrepresented backgrounds (e.g., women and/or Black students in engineering). He envisions researching and removing possible systemic learning barriers from the curriculum, pedagogy, assessment, and learning environment to make education more responsive to all learners. Halkiyo taught and worked at a university in Ethiopia, where he was also a principal investigator of the "Engendering Higher Education Curricula" research project. Dr. Halkiyo is a Fulbright-Hays Fellow, where he conducted his dissertation research on global education policy transfer from the global West/North to the global South/East, specifically Ethiopia, Africa.

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Maimuna Begum Kali is a Ph.D. candidate in the Engineering and Computing Education program at the School of Universal Computing, Construction, and Engineering Education (SUCCEED) at Florida International University (FIU). She earned her B.Sc. in Computer Science and Engineering from Bangladesh University of Engineering and Technology (BUET). Kali's research interests center on exploring the experiences of marginalized engineering students, with a particular focus on their hidden identity, mental health, and wellbeing. Her work aims to enhance inclusivity and diversity in engineering education, contributing to the larger body of research in the field.

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Background:

Our institutional systems continue to reproduce inequities in outcomes for Black, Latinx, and Indigenous engineers. While societal inequities are upheld by multiple intersecting forces, the undergraduate engineering classroom is a major force to either perpetuate inequitable disparities or broaden participation in engineering professional access. The most influential stakeholders in classrooms, engineering faculty, are poised to become great innovators to solve this complex problem, but they have limited time and assessment tools for collecting classroom data and limited contextual understandings of equity and education. To catalyze action on this widespread problem of practice, we must create partnerships between researchers and practitioners that address racial inequity in new and meaningful ways.

We see the following as key limitations in research and practice towards transforming engineering educational practice towards racial equity:

Most education research focuses on disseminating knowledge not on impact. Typical research designs in engineering education are primarily constructed to generate knowledge about a topic, not to impact practice or address inequities. Disseminating research or best practices alone does not create change [1]. Researchers should first study the actions that can create change in everyday educational contexts and then translate their impacts more widely.

Diversity, Equity, and Inclusion (DEI) scholarship is disconnected from classroom practice. While DEI scholarship has made bold critiques and provided important windows into student experiences, it tends not to study classroom interactions or critique classroom practices. Since classrooms often constitute the bulk of students' marginalizing educational experiences, more research is needed to understand the ways inequity manifests in classroom contexts.

Mechanisms of racial inequity are not analyzed. While many studies highlight marginalizing experiences of racially minoritized (Black, Latinx, Indigenous) groups [2], [3], the inequitable structures, cultures, and interactions that create those experiences are not as often explored. In contrast, several studies have looked at the structures, cultures, and interactions that create gendered inequities [4] or other forms of inequity [5]. It is time for the scholarly community to give concerted attention to understanding the mechanisms that create racial inequity.

Faculty development emphasizes faculty views, not classroom equity and outcomes. Important workshops and coaching efforts have come out of faculty development research, with a large portion of them focusing on pedagogy generally and a subset focusing on DEI [6], [7]. However, this work tends to focus on understanding and shifting faculty views and does not triangulate those views with an attention to actual faculty actions and classroom outcomes [8]. Researchers have an opportunity to close the feedback loop with faculty about their own classroom practices and engage their identities as problem solvers by focusing on classroom inequities.

Project Overview

This poster reports on the first year of a NSF CAREER Broadening Participation in Engineering (BPE) project, which begins with the premise that reproductions of inequity are particular to specific classroom and institutional contexts and require local understanding, critical reflection, and concerted action to achieve meaningful change (Figure 1). Objective 1 leverages data from classroom practice and faculty engagement sessions to triangulate findings and provide an equity

metric for faculty to attempt to shift with their pedagogical design. Analysis across contrasting university contexts (Objective 2) helps understand the particularities associated with supporting equity in those contexts while establishing the efficacy of the collaborative research process for initiating change in university classrooms. In parallel the project builds capacity with the scholarly community for research focused on racial equity and utilizing action research methods (Objective 3) and disseminates resources for equity via a web resource called the "Equity Toolbox." Finally, project findings help create an innovative theatre-based training for engineering faculty (Objective 4).

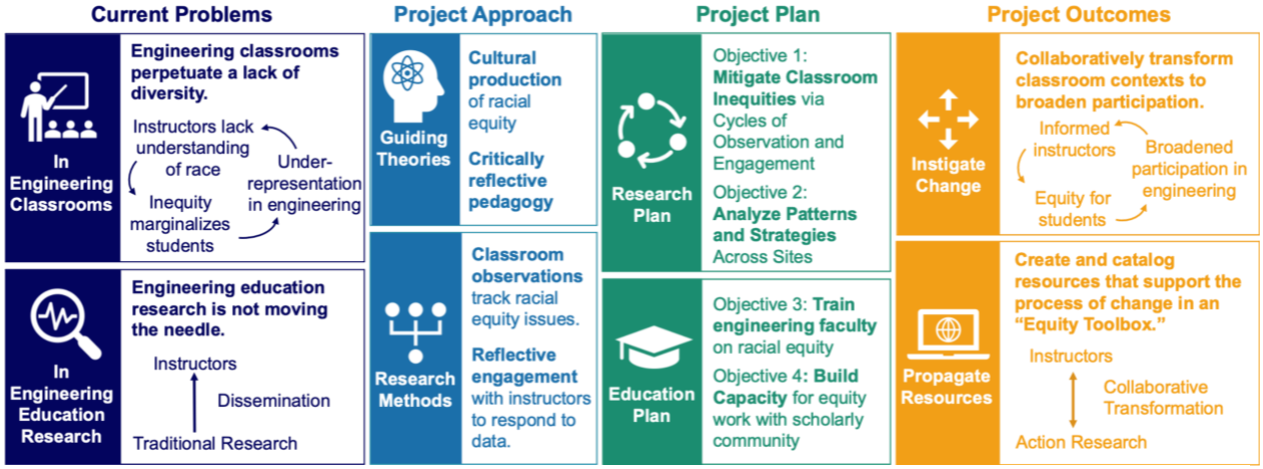

Figure 1: Project Overview

Guiding theories

The project draws on our own and others' guiding frameworks to conceptualize racial equity in engineering classrooms to engage faculty as they learn about racial equity.

From *critical race theory*, we highlight that race is not a biological reality but a social construct created for the implementation of systemic racial oppression [9]. Further, systems of racial hierarchy are more complex than the Black/White binary, and the racialization of other minority groups (including Latinx and Indigenous people) has become increasingly important to examine. To say that race is a social construct, however, does not mean that it is imagined or intangible; the tangible realities of race—the physical phenotypes associated with race, the lived experience of individuals with those phenotypes, and the material differences in the lives of individuals impacted by racial oppression—cannot be ignored [10]. We note from *intersectionality* [11] that multiple systems of privilege and oppression (e.g., race, ethnicity, class, gender, sexual orientation, language, religion) are always operating in concert in society [12] and in individual engineering classrooms. In many ways, race is the system in the United States that is the most "third rail," as racism is a strong accusation and narratives of racial colorblindness are seen as polite and safe [13]. Since many faculty rely on colorblind narratives [14], we remain aware of other intersecting systems of oppression and how narratives of race often mask themselves instead as conversations about socioeconomic or educational privilege, English fluency, academic competence, or another more "polite" topic [15].

While racial equality is often used colloquially to mean all groups are treated equally, racial *equity* can be more specifically conceptualized in accordance with specific dimensions of un/equal access and outcomes [16]. We consider several key dimensions of equity in engineering classrooms (i.e., curriculum, classroom discourse, lab/team interactions, support structures,

grading, texts) and propose a quantitative and contextual operationalization, where key dimensions should represent the racial makeup and be contextually meaningful and appropriate. Shah (2016) defined an example of equitable class participation: if a class has 21% Black students, approximately 21% of the talk time in class should be Black students talking, in cognitively demanding rather than low-level discourse (p. 1260). This quantitative and contextual approach can be expanded to examine other dimensions of in/equitable engineering classrooms.

Cultural production provides a lens into the ways that such inequities are reproduced in local settings [17], [18]. Within this framework a macro inequity, such as the racial or gender disparities in professional access, is reconstituted in local settings through a variety of structural and cultural features. For example, in Carlone et al. (2011), gendered discrepancies in access to science identity were rooted in two 4th grade instructors' responses to student questions and student norms for turn-taking. Once identified, these features can be shifted to produce a different and less oppressive outcome. Finally, we draw on Brookfield's (2017) *critically reflective pedagogy* to guide faculty development on equity issues, which are complex and require individual reflection by faculty to approach them sustainably over the long term.

Research Methods

The project research questions focus on distinct yet overlapping phenomena: patterns of classroom racial inequity, classroom transformation towards equity, and faculty learning.

RQ1 What are the patterns and circumstances of racial inequity present in engineering classrooms within contrasting institutional contexts? (Classroom Inequity)

RQ2 How, and to what extent, can faculty who are not DEI experts transform patterns of racial inequity in engineering classrooms towards equity? (Classroom Transformation)

RQ3 What are the common progressions of faculty learning on racial equity in classrooms, and what resources facilitate that learning? (Faculty Learning)

In each of four contrasting university contexts, the research team recruits and embeds with three faculty participants to observe their classroom and share insights with the small group. The semester-long research process follows an iterative process of classroom observations, analysis for equity metrics, and faculty engagement in small groups (see Figure 2).

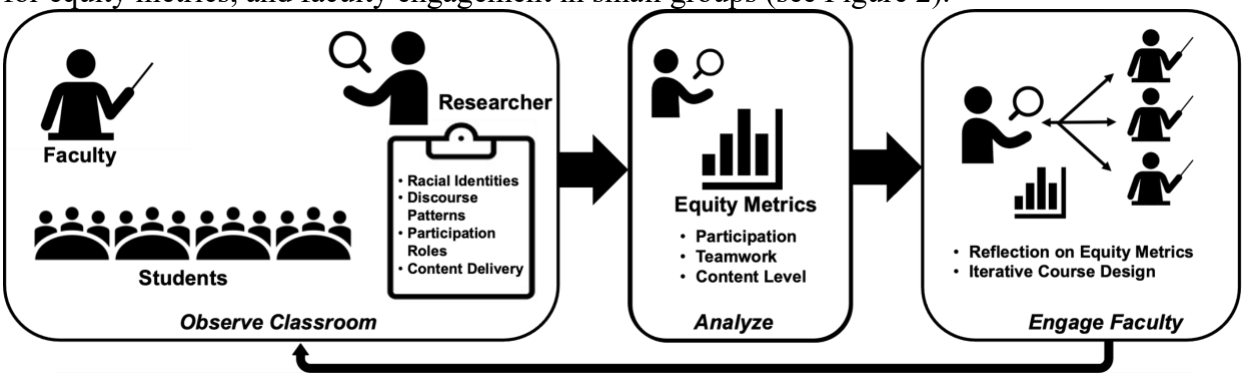

Figure 2: Research Methods for Classroom Observation and Faculty Engagement

The researcher (PI or postdoc) visits each faculty participant's classroom regularly to take observational field notes. To help identify the racial/ethnic identities of classroom participants, we distribute a short survey to acquire this information alongside other questions of interest. We

take two types of ethnographic field notes: 1) expansive field notes on the entirety of classroom events through the lens of racial equity, and 2) focused field notes that assess a specific dimension of equity as agreed upon with the faculty participant. Since the classroom contains many different racialized dynamics and since faculty members are not experts in the topic, the researchers and faculty collaboratively choose an equity goal that fits the course pedagogy.

We have three initial prototypical equity dimensions depending on the class pedagogical approach, which we suggest as possible equity goals: 1) discourse patterns, 2) team participation roles, and 3) content delivery. Each of these has emerged as influences on student affect and learning outcomes in prior PI work and literature on equity or racial equity. For example, a common discourse pattern in a discussion-based class is for a few students typically with the most educational and demographic privilege to sit near the front of the classroom and to ask many questions and participate the most heavily in classroom discourse [19]. This dynamic reinforces and exacerbates itself over time and can become a barrier to the participation of other students who may have more basic questions about the content or feel intimidated. Each of these dynamics can be seen at an overall class level without an attention to racial equity; however, this project looks specifically at these dynamics through the lens of racial equity (while cognizant of intersecting issues of gender, socioeconomic access, prior academic background, etc.).

As a regular activity (approximately every two weeks), the research team analyzes the recent focused field notes data to calculate the respective numerical equity metric (or graphical representation). This equity metric is brought to the group engagement session between researchers and the three participant faculty. In this small group, faculty members reflect on their numerical data as formative feedback about their progress towards their equity goal and discuss them collectively. The research team emphasizes during these groups that the numbers are just a singular form of insight, and we provide additional context from our expansive field notes if we think the data misrepresents the phenomenon or if there is a causal dynamic we have observed. We facilitate these small groups in a spirit of collective insight and creativity, rather than punitiveness or accusation. In discussing the data, we collaboratively consider ways to redesign the classroom approach to achieve further progress on the equity metric. The research team plans for these meetings strategically as an iterative form of intervention regarding the faculties' understandings, and bring in topics of conversation, resources from education researchers, tools from faculty development, and pedagogical strategies. The research team records the faculty engagement meetings for further discourse analysis as both representations of the progression of faculty learning on racial equity and evidence of successful mechanisms for promoting learning.

Project progress to date:

The project has finished two semesters of data collection at contrasting universities: A large public Hispanic Serving Institution and research institution in the southeastern United States, and a smaller private Predominantly White University and research institution in the northeastern United States. Our third site is an undergraduate-serving / community college context for contrast. We recruited and engaged three participant faculty at each university, and we have working on publishing on insights from pre-interview and survey processes to assess faculty DEI understandings and learning progressions. We refined our approach to supporting faculty, including feedback about the utility of certain resources, adapting our approach to a variety of class contexts (lecture problem solving classes, computer lab classes, active learning project classes), engineering topics, and levels of understanding of racial equity by faculty. We are assembling the resources we gathered to be able to share later with the community.

Despite the progress and importance of this research effort, it has recently been terminated, reflecting a shift in the NSF's stated priorities away from explicitly equity-oriented research. As a research team deeply committed to equity and systemic change, we disagree with this shift and remain steadfast in our belief in the necessity of research that moves towards racial equity in education.

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