

Using Collaborative Autoethnography to Investigate Engineering Journeys

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Abstract—This Innovative Practice work-in-progress describes the use of collaborative autoethnography (CAE) as a methodology to explore the centrality of Whiteness (as an ideology) in engineering and how it informs the culture, climate, and discourse of engineering education. We began the first year of our project by conducting a CAE on our own experiences in engineering spaces. CAE takes a collaborative approach to the process of critical self-reflection and can be conducted in many forms, such as collecting personal memory data (e.g., journaling), interviewing each other, facilitating intentional dialogue, or observing each other (e.g., in the classroom). Our team's diverse viewpoints facilitated rich conversations that let us interrogate the ways in which Whiteness reveals its form differently depending on one's positionality and ontology. In this paper, we describe our approach, experiences, and challenges with using CAE to explore our engineering journeys. Future steps include using our findings to create a faculty development program to help engineering faculty further their development of critical consciousness. For movement towards racial equity in engineering to be effective and sustainable, we believe change must begin with action in the classroom, where engineering faculty have direct interactions and influence over students' beliefs, attitudes, and value systems.

Keywords—collaborative autoethnography, racial equity

I. INTRODUCTION

Historically, engineering has prioritized the values, beliefs, experiences, and perspectives of the dominant culture created by and for White (straight, cisgender) men [1]. White men are significantly overrepresented in engineering, accounting for 66% of the engineering workforce compared to only 31% of the U.S. population [2]. According to Miller, this overrepresentation of White males in engineering is not accidental, but intentional - this demographic and culture were deliberately cultivated by early engineering institutions [3]. Hacker notes that the military roots of engineering education perpetuate a legacy of rigidity and dominance [4], as seen in examples in textbooks that tend to feature White men and militaristic or masculine themes (such as bullets or sports cars) [5]. The culture of domination is pervasive in engineering, even in the terminology used, where oppressive terms are commonly used without question. For instance, in electrical engineering, terms such as "master and slave" are used to describe how one device controls another [6-7]. In mechanical engineering, "male and female" are used to describe fastener components connected by insertion. While masculinity in engineering has been extensively studied [e.g., 8-10], the impact of Whiteness has received less attention.

The culture of Whiteness regulates who participates in engineering. Engineering can be framed as an exclusionary space, as evidenced by the lack of diversity and lower retention rates of students and faculty of color [11-12]. The analogy of a leaky pipeline is commonly used to explain the underrepresentation of students of color in engineering, but this analogy is flawed as it focuses exclusively on the supply side of the "underrepresentation problem" [13-14]. The problem is not the low number of people of color entering the system, but the culture of the system itself, which marginalizes those who do not conform to the White male hegemonic discourse. The lack of diversity in engineering is a direct consequence of "a STEM education system perfectly functioning as designed by the system's architects" [15]. Achieving racial equity in engineering education requires a fundamental shift in thinking and a reframing of our understanding of our culture. Representation is not the same as power. We need to start seeing underrepresentation as a symptom of the root cause of the problem—the culture of engineering that creates an unwelcoming environment for minoritized students and faculty.

Our project aims to investigate the influence and pervasiveness of Whiteness in engineering culture. We argue that Whiteness is a central part of the exclusionary culture within engineering and underlies the systemic barriers that negatively impact racial equity. In this paper, we describe the first steps of our project, funded by the National Science Foundation Racial Equity in STEM Education Program, through which we are working to shift our understanding of racial equity. We utilize collaborative autoethnography to begin identifying the hidden scripts of Whiteness in engineering education.

A. The Hidden Scripts of Whiteness in Engineering Education

We argue that within engineering education, hidden scripts of Whiteness create a systemic barrier that prevent engineers from addressing issues of systemic racism. Whiteness is embedded throughout all institutions in the U.S., including education [16-19]. These scripts (in the form of values, attitudes, behaviors, actions, etc.) are so ingrained in U.S. culture that research has revealed even four-year-old children have begun to internalize the scripts of Whiteness [20]. These scripts of Whiteness are manifested when "everyone is more or less expected to follow scripts that sustain white privilege" [21, p. 36]. Scripts of Whiteness operate in regulative ways to dictate how, why, and when individuals within a particular space can or cannot name incidences of racism. In engineering, these may include normative practices such as the unquestionable

acceptance of authority [22] or the assumption that engineering work is race and gender-free [23].

One of the ways in which these scripts manifest in engineering classrooms is through what knowledge is valued and taught. Traditional engineering curricula overemphasizes theories and innovations from the Industrial Revolution [24] and too often gives credit to White men for knowledge developed by Indigenous People, or the ways in which Black, Indigenous and People of Color (BIPOC) have contributed to engineering knowledge construction. As one example, Goodyear is often credited with inventing processed rubber, rather than Mesoamericans such as the Mayans [25-26]. Similarly the achievements of non-White people, such as the contributions of African American mathematicians in the space program [27], are rarely mentioned in engineering texts. This normalized nature of Whiteness has rendered these achievements invisible, creating a systemic barrier that makes it difficult to identify, challenge and (re)imagine racial equity in engineering.

We claim the centrality of Whiteness in engineering curricula informs the culture and climate of engineering education. These scripts impact the daily experiences of students and faculty of color and contribute to the lack of diversity in these spaces. Several studies indicate the role institutional climate plays in the success of minoritized students. For instance, African American men at Primarily White Institutions (PWIs) reported lower academic achievement and self-concept, reduced feeling of support, increased stereotype threat, and increased microaggressions compared to their counterparts at Historically Black Colleges and Universities (HBCUs) [e.g., 28–30]. In addition, the historical struggle of Latinos/as/xs' access to quality, culturally-relevant public education is evidenced today through their systematic exclusion from engineering fields. The banning of the Spanish language in schools, the over-disciplining of Latino/a/x students, and the never-ending deficit thinking ideologies resulting in subtractive schooling and a Eurocentric curriculum [e.g., 31–33] demonstrate that institutions serve as sites of social reproduction that privilege White norms, values, and discourses.

Faculty are also negatively impacted by scripts of Whiteness [34]. Research has shown that faculty of color leave academia due to institutional climate [35–36], report lower job satisfaction [37], and face hostile or challenging work environments at disproportionately higher rates [38–39] than their White counterparts. Faculty of color are more likely to face microaggressions, have their competence questioned, scholarship devalued, and race or ethnicity used to justify excessive service and committee work [40–42]. In addition to the usual concerns about tenure and promotion, faculty of color have an additional cognitive load they must navigate based on perceptions about their identity [43], which takes an emotional and occupational toll and contributes to a perception of faculty of color as being less productive [40]. Without a fundamental reframing of engineering culture, faculty of color are placed in a double bind—presumed responsible for shepherding students of color through the curriculum, or the lack of faculty of color is blamed for the diversity problem in the student population [44], [45]. Thus scripts of Whiteness are more than just everyday verbal or textual interactions; they are learned, emulated, and

become entangled in a systemic structure that is difficult to dismantle.

The scripts of Whiteness in engineering, especially when unnamed, create a systemic barrier to beginning to address racial equity in engineering education. Faculty, as mentors and authorities of engineering curricula, create and foster the culture both in the classroom and throughout institutions of higher learning. However, merely attaining a critical mass of non-White faculty does not inherently make a space inclusive and supportive. Moreover, non-White faculty situated in White institutions teaching a White curriculum are not empowered nor likely to have the tools to tackle racial inequity in their classrooms. Our research works to name and challenge scripts of Whiteness in engineering education and support faculty in decentering Whiteness from their ways of thinking so they can begin to move engineering education toward racial equity.

II. IDENTIFYING AND NAMING WHITENESS THROUGH COLLABORATIVE AUTOETHNORAPHY

The first step in changing the culture of Whiteness within engineering education is to first make this barrier visible. For too many engineering faculty, Whiteness is invisible to their own ways of being, knowing, and doing. Faculty need help to recognize the culture, climate, and curriculum that is invisible and which we were all trained within. We are like fish unable to recognize the water in which we swim; the omnipresence of Whiteness hides in plain sight [46].

Whiteness has been largely overlooked as a force that shapes the ways in which engineers think—including our own, as faculty trained in traditional engineering disciplines and academic processes. We began this enigmatic endeavor of naming Whiteness by leveraging the experiences of our diverse team to investigate the scripts of Whiteness within engineering education through a collaborative autoethnography (CAE). CAE is a qualitative research method where researchers examine their lived-experience to gain a deeper understanding of the sociocultural and sociopolitical context that surrounds them [47]. Our team consists of an Asian American woman, Latino man, White woman, and White man, bringing together diverse viewpoints that span multiple identities at the intersections of gender, race, sexual orientation, ethnicity, language, and age. By starting with our own lived experience, we gathered instances that exemplify Whiteness in engineering in order to describe the cultural norms and practices in which Whiteness exists. We choose to focus on collaborative autoethnographic work because engineering is the space we occupy and navigate, and because “we cannot understand the social world by studying artificial simulations of it” [48, p. 9]. In addition, a collaborative autoethnographic approach would allow us to identify the systemic realities of the engineering spaces we inhabit by collecting our stories around our interactions with others, our paths, and our lived realities to create a more thorough picture of the phenomenon.

A. Collaborative Autoethnography in Literature

Collaborative autoethnography takes a collaborative approach to the process of critical self-reflection. The goal of this approach is to leverage researchers' lived experience to examine the socio-cultural context in which they find

themselves, and to more deeply understand how their epistemology is driven by their positionalities [47, 49]. The collaborative approach, in comparison with a (solo) autoethnography (AE) which is sometimes critiqued for its myopic nature, connects individual researchers' narratives into a larger shared experience [47, 49]. By including diverse perspectives on the research team, it is possible to strengthen the depth of engagement and potential impact of the work beyond a traditional autoethnographic approach [50]. CAE can take many forms such as collecting personal memory data, interviewing, intentional dialogue, or observing each other [51]. CAE is not a linear process, but requires an ongoing dialogue (conversations, negotiations, or even arguments) between researcher team members over a long period of time (at least months, if not years) [51].

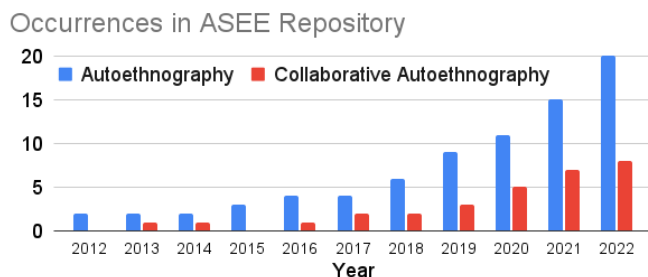


Fig. 1. Occurrences of “autoethnography” and “collaborative autoethnography” in the ASEE paper repository

A relatively new technique to engineering education in the United States, the first time AE and CAE appear in the American Society for Engineering Education’s (ASEE) Papers on Engineering Education Repository (peer.asee.org) are in 2012 and 2013, with only eight papers mentioning the collaborative approach in 2022. This data were acquired by searching the ASEE repository for “collaborative autoethnography” and “autoethnography”, and results were included if the term appeared in the title, keyword, or full text of a paper. Of these papers, CAE has been used by engineering education researchers to textually capture the experiences individuals have had in different institutional climates [52], in roles of mentoring or transition [53–55], and in facing systemic barriers due to identity [56–57]. We draw on the experience of these scholars to inform the process and documentation of our own CAE.

B. Collaborative Autoethnography in Practice

We began this research with critical self-reflection to think and analyze the “frames we use for thinking whilst reflecting on what we are doing in the production of meaning” [58, p. 470]. Even though we are a closely-knit group, agreeing to step into this type of experience meant re-negotiating some of our roles and relationships. For example, one team member who is the department chair of other members had to choose to cross professional boundaries in sharing deeply personal stories to help team members develop a deeper understanding of their positionality.

After reviewing the existing works on CAE in engineering education, which revealed the breadth of types of publications that can manifest, we slowly waded into conducting our own CAE with the help of an advisory board member skilled in

collaborative autoethnography. We began with bracketing—privately writing out our hopes, expectations, and concerns—to anticipate our own reactions and strong emotions that might arise later during the CAE. These could include external hopes and fears for the project, relational concerns about teammates, or internal assumptions or beliefs about ourselves, our work, Whiteness, or engineering that we hold. To kick off our CAE journey, we chose a low-stakes topic to ease into the process and examine where our strengths and weaknesses lie in the process of writing, story-telling, and active listening. We each wrote and read aloud the story of our names—how it was chosen, how we feel about it, or how our relationship with our name has changed over time. As we eased into our engineering stories, we chose to look backwards and tell the history of our childhood formations and how those contributed to our becoming engineers. Our most recent CAE topic dove headfirst into critical incidents along our engineering journeys (from college, where we first publicly declared our engineering intentions, through the start of our faculty careers).

We chose to begin our CAE by gazing internally at our own identities and histories as a way to deepen our understanding of each other. Not only was the goal to deepen our personal connections and build trust, but also to practice vulnerability in what were otherwise professional relationships. We used the first several sessions to find what worked for each of us in terms of journaling vs. audio recordings, long-form writing vs. jotting notes across many days, etc. We found that team members gravitated towards various techniques, such as reading our stories aloud verbatim or re-creating the story live from key points. In two cases, team members had to experiment with technique to refrain from “getting stuck” in structured writing and allow for more emotional expression to come through in storytelling.

Some of the obstacles we encountered ranged from logistical to emotional. With one team member at another institution, and with future plans to conduct CAEs with participants completely remotely, we had to practice collaborative autoethnography online. The first few sessions were held synchronously via Zoom. We decided to hold the critical incidents session in person given the more sensitive stories being told. (In other words, it is hard to give/receive a hug when you are on a screen.) Finding a regular time to meet to continue building momentum in our rapport was also challenging as faculty with full teaching loads. While the in-person session we held was intentionally scheduled to be several hours long (with breaks!), these long weekend sessions are likely infeasible for faculty participating in this program in the future. After building some familiarity with CAE, we shifted towards shorter one-hour block sessions that featured one storyteller at a time and spanned multiple weeks to complete one topic. We are aware of power dynamics that might be at play; an issue that we will also need to be cautious of when grouping participants in the future. Oftentimes the CAE evolved with our conversations; several times we had to pivot to an entirely new plan for the next session given the discussion around the last.

In addition to the CAE sessions, we also have been doing guided reflective journaling and observations of how our meetings go. One critical anchor to the research that we have identified thus far is that Whiteness can seem more invisible to White individuals; yet the full picture of Whiteness cannot be defined by non-White experiences. We are still working on exploring this delicate balance as we tease out scripts of Whiteness through our CAE.

C. Next Steps

Moving forward, we will examine our shared experiences (rather than individual experiences) in engineering spaces. For example, we can take a critical incident approach [47, 59, 60] to compare our experiences facing administrative barriers in similar situations, such as requesting classroom funds or in managing class waitlists, but involving individuals of different identities (i.e., the intersections of race and gender), or discuss our reactions to an explosive faculty meeting where we were all present. Together, these data will help us to identify the influence of Whiteness on power and group dynamics, as well as the creation and emulation of scripts of Whiteness in those spaces. They will also provide a foundation to understand the cultural factors influencing our community, our interactions with that community, and the interactions between actors in that space.

Journaling and observational data from our CAE sessions will set the stage for our intentional dialogue about the role of Whiteness in engineering. Here our diverse viewpoints have helped to facilitate rich conversations that let us interrogate the ways in which Whiteness reveals its form differently depending on one's positionality. We have recorded and transcribed these conversations, which we will later thematically analyze and put in conversation with our other data [47] using a critical discourse analysis framework [61-62]. This data will help to identify our initial set of common scripts of Whiteness in engineering.

III. CONCLUSION

We hope this project will make a substantial contribution in guiding engineering faculty members to recognize, interrogate, and eventually dismantle forces of racial inequity in engineering higher education. This work-in-progress helps to lay the foundation for the development of a faculty development program in the future, where we will guide participants to develop their own critical consciousness and investigate the role of Whiteness in engineering education through their own facilitated CAE. Our project will enable faculty to co-construct, from within their own contexts and their own perspectives, a critical awareness of the common scripts of White, male, hegemonic discourses central to engineering; how engineering faculty negotiate their identities with these ideologies or discourses of Whiteness; and how the Whiteness of engineering curricula manifests in their teaching.

By reframing our focus from the long-held approach to address the "deficiencies of minorities" to examination of "the environment that minoritizes a group of people," we can identify and begin to problematize Whiteness and work to illuminate it and deconstruct its power. To challenge the

hegemonic discourse of Whiteness, faculty need to be able to discern Whiteness in engineering for themselves so that they can begin to confront it with both their students and colleagues.

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