# Scripts of Whiteness in engineering: An analysis of the literature

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# Scripts of Whiteness in Engineering: An Analysis of the Literature

**Introduction**

In this paper, we argue that scripts of whiteness in engineering are detrimental for Black, Indigenous, and People of Color (BIPOC) because they keep racialization in engineering spaces in perpetual motion through the guise and myth of colorblindness and meritocracy. By *scripts* we mean the cognitive dynamics (i.e., assertions, attitudes, ways of being and doing) that involve the schemas and frames of reference that build one's engineering identity [1]. We posit that individuals in engineering spaces, white and those with a proximity to Whiteness (proximity to Whiteness refers to having access to certain forms of power, resources, benefits at the expense of BIPOC, even when not a part of the majority or the group in power) are not only conditioned to scripts of whiteness, but also become the bearers of racialized hierarchical classifications to maintain power and sustain systemic barriers in engineering education. We draw from Critical Race Theory (CRT) and Critical Whiteness Studies (CWS) to frame the current landscape of engineering spaces and how Whiteness continues to be central to engineering discourse while being veiled under colorblindness and meritocracy to keep functioning under the banner of business as usual.

Previous research in engineering education has identified the characteristics and behaviors associated with being an engineer, including aspects such as norms, professionalism, and standards [2-8]. These studies have also explored the reasons why historically marginalized students--particularly Black, Indigenous, and people of color (BIPOC)--may experience a sense of alienation from the engineering field [9]. In the realm of engineering, learning how to become an engineer is shaped through these norms, professionalism, and standards as well as the hidden curriculum—everyday interactions and the cognitive dynamics that are involved in those interactions [10]. As individuals engage with the field, they develop scripts by adopting the behaviors and traits that are recognized as traditional characteristics of engineers by their mentors, professors, peers, industry leaders, and others within the engineering community. Young engineers learn to employ the language, phrases, practices, skills, values, and beliefs that signify their acquisition of the social – often racialized – constructs associated with the engineering world while allowing them to acculturate within their respective field.

Moreover, engineering scripts have often centered around gender (i.e., masculinization) but lack an intersectional orientation with Whiteness – a socially constructed formation that functions as a system of social control [11]. Some examples of Whiteness include the racialization of students of color and their portrayal as incapable of performing in engineering (i.e., deficit ideologies) [12-14], the idea that engineering knowledge is only constructed in English (i.e., language subtraction) [15, 16], or the perception that people are selected to engineering spaces just based on ability (i.e., meritocracy) [17, 18]. Due to a decades-long decline in the number of white Americans, new census demographic data shows that "all of the nation's 2010-2020 growth is attributable to people of color—those identifying as Latiné or Hispanic, Black, Asian American, Native Hawaiian or Pacific Islander, Native American, and as two or more races" [19]. White people comprise 59% of the US population yet white workers make up 67% of STEM workers [20]. In engineering and architecture, the disproportionate number of white workers is an astounding [21]. To better understand the disparities in

engineering and lack of racial parity in engineering education, it is important to see how Whiteness continues to be present in engineering spaces. To that end, the authors view the literature through the lens of CRT and more specifically CWS as a crucial aspect of exploration for engineering education research.

## Positionality

The team has several different intersectional identities. The group includes two women and three men, of which one is a white man, one white woman, one Asian American woman, one Mexican American man, and one Black/white biracial man. All have doctoral degrees—four in engineering and one in education. All of the authors have transformative world views, which "holds that research inquiry needs to be intertwined with politics and a political change agenda to confront social oppression at whatever levels it occurs [22, p.9]. The lead author is an outsider to engineering and comes from the discipline of education– more specifically a critical and focused on racial literacy. It was his task to examine engineering culture through the literature in engineering/education and Whiteness. The themes that emerged might often be seen simply as problems the discipline faces rather than their own findings.

In this paper, we follow Jerry Rosiek and Kathy Kinslow (2016) in choosing to capitalize Black but not white, because "Capitalized, it signifies a conscious project of resisting institutionalized racism. We chose not to capitalize "white" because at this point in our history there is no collective "White" identity organized around the project of resistance to institutionalized racism." [23, p. xxxvii]. However, we choose to capitalize Whiteness because it describes a system of oppression, domination, and economic exploitation working in the service of white supremacy.

## Theoretical lens
### CRT & CWS

We draw from the theoretical frameworks of Critical Race Theory (CRT) and Critical Whiteness Studies (CWS) to present – and challenge – the frames of reference used in engineering and engineering education research under the veil of Whiteness. In that sense, our aim is to ensure that engineering/education reckons with the reality of educational disparities and its impact on BIPOC in order to dismantle the institutionalized systems that have historically created the foundation of engineering [24].

CRT originated as an academic movement to navigate the intersection of race and the law after the failure of the Civil Rights Movement due to a dissatisfaction with the well-trodden civil rights discourse, the turtle-like pace of sustained race reform, and "the seeming inability of mainstream liberal thinking on race to effectively counter the erosion of civil rights accomplishments" [25, p. 344]. Some of the early thinkers of this concept were Derrick Bell, Kimberlé Crenshaw, Allen Freeman, Richard Delgado, Cheryl Harris, Charles Lawrence, Mari Matsuda, and Patricia Williams [26]. The lens of CRT has made its way into several disciplines including but not limited to sociology [27-29], medical and health sciences [30, 31] and education [32-35].

We are informed by the literature of CRT in education which holds as a main principle that race and racism are normal and continue to be present in today's American society. Delgado and Stefancic (2001) operate from the assumption that racism saturates every aspect of US society and that racism "is the usual way society does business, the common everyday experiences of most people of color in this country" [36, p.7]. CRT in education was first employed by Gloria Ladson-Billings and William Tate (1995) who "challenge claims of neutrality, objectivity, color-blindness, and meritocracy in education" [32, p.52].

Under the umbrella of CRT is the field of Critical Whiteness Studies (CWS). Cheryl Matias and colleagues (2014) define CWS as a way to "problematize the normality of hegemonic whiteness" because most white people "deflect, ignore, or dismiss their role, racialization, and privilege in race dynamics" [37, p.291]. The field of CWS owes much of its foundation to scholars and authors of color such as W.E.B. DuBois, Ida B. Wells, bell hooks, Toni Morrison, C.L.R. James, and Carter G Woodson who spoke to the gaze of Whiteness. These historical understandings of race and Whiteness also derive from theorizing colonization and its subjectivation of the colonized by people such as Albert Memmi, Frantz Fanon, Édouard Glissant, Suzanne and Aimé Césaire, Sylvia Wynter, and Jean-Paul Sartre.

**Describing whiteness**

Whiteness is the way that white people's customs, culture, and morals have been normalized and to which all other races are held in comparison [38]. The trend and pattern of Whiteness can be traced to the origins of colonization and the need for the colonized to assimilate to Whiteness by forgoing their own customs and traditions [39]. The concept and framework of Whiteness goes beyond the simplistic notion of skin color. Several entities have expounded upon the concept of proximity to Whiteness and how people of other skin tones will kowtow to Whiteness—even if against their own self-interests— as a response to racial trauma and protection against racism [40-42]. The concept of Whiteness exceeds skin tone and manifests itself in pillars of our society as systemic and institutional racism such as policing [43,44], the healthcare system [46-48], and education [48-51]. Whiteness is at the center of racist ideas and frameworks, and upholds white supremacy [52-58]. Such a deeply entrenched system of oppression both holds up and normalizes Whiteness while pressing down on people of color [59].

**Research process and analysis**

The researchers of this paper primarily used the snowballing technique for systematic literature reviews. That is, the authors identified a set of relevant papers, analyzed them, and explored important citations and references. This continued until a point of saturation. This was coupled with a focused search on Google Scholar with the key words of: Whiteness in STEM, Whiteness in engineering.

**Findings and discussion:  The myth of meritocracy and colorblindness**

The myth of meritocracy is a product of Whiteness and has a stranglehold on engineering. The belief in the myth of meritocracy allows the gaze of who is and isn't successful

to focus on individuals rather than a framework that looks like a flow chart in which familial wealth, race, generational legacies, and intersectional identities all have a major impact on individuals' success [61, 62]. When presenting white students with the idea that meritocracy is a myth and that no one person does it on their own, white students often feel assaulted and attacked as though they did not work hard to get where they are [63]. Pointing out that meritocracy is built upon a bed of privileges that go unseen to the beneficiary oftentimes incites a visceral display of emotions as though their work ethic, will, and determination is in question [64]. A belief in meritocracy for white students also makes them believe that they are deserving—entitled—to whatever success they are granted. In engineering, meritocracy shows itself in the manner "that students must prove themselves to be engineers, and they will make it only if they work really hard through the 'death march' of math and science courses" [62, p. 11]. More specifically to engineering, a blind belief of meritocracy in engineering gives a false sense that, since the education, training, and work is hard, this will set them up for easy and wealthy lives [65]. Since these beliefs are so ingrained into their sense of identity, letting go of the myth of meritocracy for engineers is as difficult as unweaving fine fibers.

A colorblind ideology feeds into the myth of meritocracy and works two ways—it turns the gaze from understanding how institutions reproduce the normalized standard of white supremacy and racism, to racism and white supremacy being located in individuals. A colorblind mentality also bestows these privileges that whites get as an act of merit—as though only their hard work was the reason for the benefits they received rather than locating the reasoning of said privileges to a system that reproduces advantages like an assembly line. Meritocracy and colorblindness feed into each other – a colorblind society dominated by Whiteness ignores the hierarchical positioning of groups based on racialized ideologies, leading to the belief that success is based on inherent merits.

A colorblind ideology also allows whites to benefit from white supremacy in a passive collective manner. This absolves them of any guilt or compliance seen as a conscious approval of a system that advantages Whiteness while disadvantaging others. Dan Batty and Luis Levya (2016) believe that "colorblindness shifts explicit racial arguments about genetics to supposedly non-racial arguments of proxies of student failure, uncaring parents, and devaluing of education, which leaves Whiteness invisible and allows those who assert it to defend their views in apparent non-racial ways" (66, p.56).

Studying Whiteness in STEM and more specifically engineering crosses from the focus on the skin-tone of an individual to focusing on the systems in place that allow there to be a glutton of white identities in these disciplines and fields. By realizing that Whiteness is an ideology that both white and BIPOC operate under, problem-solving becomes more about structures rather than individuals. What are administrators in engineering education doing that doesn't allow for more BIPOC to be attracted, retained, graduated, and become leaders in engineering? [67-69] Taking a more holistic view, what are the pedagogical strategies being implemented in k-12 that don't allow diverse students to see themselves as valuable in STEM fields? Notice that we aren't asking about individuals and ways that one person can make a change (although those are welcomed and necessary). We are asking about structural change that shifts the focus from either individual success stories of POC that have made it (and the subsequent coping with racism they employed to succeed), to ways the system is set up to either

push POC out when engaged (lack of feelings of belonging etc.), or gatekeep them out before they even arrive (k-12 mathematics).

Through the theoretical frameworks of CRT and CWS, there is extant research that displays how colorblind ideologies that turn into policies reproduce Whiteness by producing material stratification [66]. These material stratifications are perpetuated and sustained through a colorblind ideology and turns the gaze away from systemic failures to minority populations, to the importance of individual work and success through merit. If we ignore the racism that colorblind ideologies perpetuate and sustain, "we unknowingly subscribe to hegemonic Whiteness and do not critically think about how society's norms, standards, and expectations affect power and oppression" [70, p. 25].

Amy Slaton (2015) reminds us that "industrial capitalism has naturalized the idea that there must be managers and workers, salaried and wage labor pools and American education reproduces that structure along with attendant, variable levels of security, intellectual reward or remuneration" [71, p. 181]. Engineering in the USA has adopted (or integrated/embraced) the principles of individualism, meritocracy, and exceptionalism so that they continue to be part of the dominant discourse in engineering without highlighting how Whiteness itself has contributed to these framings.

**Conclusion**

If the system of Whiteness acts as though those that receive benefits, deserved and worked hard for said benefits (rather than these benefits being part of a larger system), those that don't receive said benefits must be seen as deficient, deviant, not worthy, and inferior to the norm of Whiteness. It is this bifurcated system of benefits—to simultaneously hold Whiteness up while pressing the others down—that allows Whiteness to maintain its hold on society and more specifically in engineering. Any attempts at diversity, equity, and inclusion that do not address the systemic and self-sustaining nature of Whiteness are doomed. This also allows for the perpetuation of exclusionary practices that begin to explain how Whiteness as property [72] protects itself and has infiltrated the sciences [73]. These issues will be pursued in future scholarship.

Following this trajectory and through the lens of CWS, we can see how Whiteness functions by dictating the distribution of resources, labor, and space. By realizing that Whiteness is an ideology that both white people and BIPOC operate under, problem-solving becomes more about structures rather than individuals. What are administrators in engineering education doing that doesn't allow for more BIPOC to be attracted, retained, graduated, and become leaders in engineering [67-69]? If we continue to ignore Whiteness and its operation within engineering—whether we want to see or admit it—our students of color are being dehumanized while we chose to maintain and perpetuate white supremacy [70].

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