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Toward an Anti-Racist Engineering Classroom for 2020 and Beyond: A Starter Kit

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Thanks to recent work by Dr. Ibram Kendi (2019), the Black Lives Matter Movement, and decades of research by critical race theorists (Bell, 1995; Crenshaw, Gotanda, Peller & Thomas, 1995; Delgado & Stefancic, 2017; Ladson-Billings & Tate, 1995; Williams, 1998), the terms *anti-racism* and *social justice* have become increasingly acceptable and widely used. The engineering education community should continue to use the contemporary social momentum and fight against injustice to create more anti-racist engineering classrooms. The question becomes, "Where and how do engineering educators start the process of creating more anti-racist engineering classrooms?" Many Black scholars have already provided an initial roadmap. These scholars research student/faculty racial composition, power dynamics between faculty and students, and the overall racially hostile climate in engineering (McGee, 2020; McGee et al., 2019; Strayhorn et al., 2013). Black scholars have discussed the syllabi, textbooks, and accompanying curriculum as minimizing Black STEM intellectual contributions (Bradley, 2019; Long & Mejia, 2016; McGee, 2020; Provenzo, Shaver & Bello, 2011). They've highlighted pedagogical techniques involving active learning and real-world context, frequent and formative feedback, and entrepreneurship as ways to empower Black students (Long, 2019a; 2019b; Long & Sun, 2018; Strayhorn at al., 2013). More generally, but just as important, Black scholars have shed light on unconscious bias, microaggressions, and various forms of racism (Baber, 2015; Burt et al., 2016; 2019; McGee, 2020; McGee et al., 2019). As engineering educators, we must protect the mental, physical, and spiritual well-being of Black people, which urgently necessitates boldly denouncing racism and enacting anti-racist practices in engineering classrooms.

Engineering education classrooms are transforming into spaces focused on advancing critical and ethical skills in addition to technical skills (Ceylan & Lee, 2003; Gunnink & Bernhardt, 2002; Siller, 2001). Yet, as countless Black people continue to be murdered by White police officers and vigilante citizens, many engineering classrooms have not served as spaces for addressing present and past racist societal events. George Floyd, Breonna Taylor, Ahmad Arbery, Trayvon Martin, Sandra Bland, Eric Garner, Tamir Rice, Laquan McDonald, Aiyanna Stanley-Jones, Walter Scott, Kathryn Johnston, Philando Castile, Alberta Spruill, Samuel Dubose, and many others are much more than hashtags.

Their lives matter. Black residents who've experienced water pollution in Flint, MI, and those who were negatively affected by Hurricane Katrina in New Orleans, LA, matter too. Engineering classrooms must move beyond focusing solely on technical proficiency and become places where social justice and anti-racism concepts are infused into the design and implementation of the course. Civil and human rights must be directly linked to engineering ethics. People must matter more than engineered products or profits. As engineering educators, we cannot exist within a bubble. We must lean into the current moment to acknowledge that the systemic oppression of Black people in engineering is directly connected to the disparaging of Black life in society.

As a follower of Christ who recognizes how the marginalization of Black people in engineering corresponds to the disparaging of Black life in society, my motto and recommendation are to "lead with love, follow up with justice!" Well, where's the love from the engineering education community? Where is the empathy? Where's the justice or equity? Where's the responsibility or repentance? Are you an ally or accomplice in fighting racial oppression (Harden & Harden-Moore, 2017)? To create more support and protection for Black people, I propose an anti-racist starter kit for use in undergraduate engineering classrooms. As a scholar and activist, Dr. Angela Davis declares, "In a racist society, it is not enough to be non-racist, we must be anti-racist." Thus, I submit this article as a call to action. What follows are 20 recommended action items for the 2020 engineering education community.

20 ACTION ITEMS TO IMPLEMENT

Culture

1. Speak up and speak out against violence towards Black people by leading with empathy, following up with advocacy and finishing with recommended adjustments (e.g., concerning our safety and empowerment) (Ben & Jerry's, 2020)
2. Refer to Black engineering students as "minoritized" instead of a "minority" to switch the focus from Black people as a numerical minority to a system that depends on Black and Brown people losing out in terms of educational, economic, and other opportunities and achievements. Hegemonic and institutionalized worldviews prevent Black students from successfully pursuing careers that align with their passions (Harper, 2012; McGee & Robinson, 2019)
3. Change engineering culture to create hospitable anti-racist spaces for Black students and those who are not affluent, non-disabled, heterosexual White men (Allen, 2017; Burt et al., 2019, 2016; Long & Mejia, 2016; McGee & Robinson, 2019; McGee et al., 2019; McGee, 2020; Strayhorn et al., 2013)
4. Advocate for an end to White male supremacy and any use of eugenics in engineering culture that may cause engineering educators to view White student achievement as "natural" and Black student failure as inevitable (McGee, 2020)

5. Increase reporting options for racist incidents and strengthen policies to deter racism by rescinding offers to prospective students and expelling current students who engage in racist activities (Anderson, 2020)

Pedagogy

6. Use culturally relevant and sustaining pedagogies and anti-deficit thinking (Harper, 2010; Ladson-Billings, 2014; 1995)
7. Implement active learning techniques and use real-world problems instead of heavily relying on lecturing accompanied by abstract examples (Long & Sun, 2018; Strayhorn et al., 2013)
8. Leverage the proven strategies of historically Black colleges and universities (HBCUs) for helping Black students succeed in engineering such as a) "leading with soul," b) providing Black students with secure and safe learning spaces to be their authentic and best selves, c) implementing course-based research experiences, d) using adaptive learning courseware, e) having mindfulness to reduce math anxiety, and f) developing metacognition to support racial equity (McGee, 2020; Rankins, 2019; Savage, 2017)
9. Regularly encourage and reward Black students, while enabling them to experience joy plus success instead of disappointment and harsh penalties (Moore et al., 2003)
10. Frequently solicit and respond to pedagogical concerns from Black students and alumni (Long, 2019b; Strayhorn at al., 2013)

Curriculum

11. Edit the undergraduate engineering curriculum to celebrate contributions from Black innovators and theorists (Bradley, 2019; Long & Mejia, 2016; McGee, 2020; Provenzo et al., 2011)
12. Update the undergraduate engineering curriculum to prepare Black students not only for jobs in industry and academia but also for entrepreneurial endeavors (Long & Sun, 2018; McGee, 2020)
13. Offer free or subsidized academic textbooks, educational software, and credentialing exams to Black students with unmet financial need (Moore et al., 2003)
14. Empower experienced Black engineering student leaders to help redesign the curriculum (Long et al., 2018)
15. Work with educational consultants to remove racialized bias in curricular assessments (McGee, 2020)

Personnel

16. Remove racialized bias from the faculty and student hiring process as well as the student admissions process (Baber, 2015; McGee & Robinson, 2019; McGee, 2020)

17. Actively and competitively recruit new Black faculty members and academic advisors (Baber, 2015; McGee & Robinson, 2019; McGee, 2020)
18. Partner with HBCUs to recruit new Black faculty members and graduate students (McGee, 2020)
19. Actively and competitively recruit Black students as teaching assistants and tutors (Baber, 2015; McGee & Robinson, 2019; McGee, 2020)
20. Partner with predominantly Black K-12 schools to recruit new Black undergraduate engineering students (Strayhorn et al., 2013)

This guest editorial is only a starting point toward creating anti-racist engineering classrooms for 2020 and beyond. In the words of Dr. Ibram Kendi (2016), "I'll never lose my faith that you and I can create an anti-racist America where racial disparities are nonexistent. Where Americans are no longer manipulated by racist ideas. Where Black lives matter." As engineering educators, we must continue to believe we can create anti-racist engineering classrooms (Brown, Morning & Watkins, 2004, 2005; McGee & Martin, 2011; Moore, Madison-Colmore & Smith, 2003; Pawley, Mejia & Revelo, 2018). Then, we must urgently identify racial inequities and enact practices and policies to eliminate them. We must always ensure our work is student-centered, with an intentional, unrelenting, and unapologetic focus on proving how much Black lives matter inside and outside of engineering classrooms.

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REFERENCES

Allen, A. M. (2017). *Do we know who is really doing the planting? A case study of traditionally White institutions identified as top degree producers of Black engineering undergraduates*. (Unpublished doctoral dissertation). University of Pittsburgh, Pittsburgh, PA.

Anderson, G. (2020, June 8). Universities revoke admissions offers. *Inside Higher Education*. Retrieved from https://www.insidehighered.com/admissions/article/2020/06/08/universities-revoke-admission-offers-over-hateful-speech?utm_source=Inside+Higher+Ed&utm_campaign=c32be9f1fc-DiversityMatters_COPY_01&utm_medium=email&utm_term=0_1fcbc04421-c32be9f1fc-226489065&mc_cid=c32be9f1fc&mc_eid=8267b2c039

Baber, L. D. (2015). Considering the interest-convergence dilemma in STEM education. *Review of Higher Education, 38*, 251–270.

Bell, D. (1995). Who's afraid of critical race theory? *University of Illinois Law Review*, 1995, 893–910.

Ben & Jerry's Homemade, Inc. (2020). *We must dismantle White supremacy: Silence is not an option* [Press release]. Retrieved from https://www.benjerry.com/about-us/media-center/dismantle-white-supremac

Bradley, J. (2019, August 6). From good science and engineering research to entrepreneurship. Retrieved from https://blackengineeringphd.org/mentoring-portal/

Brown, A. R., Morning, C., & Watkins, C. B. (2004). Implications of African American engineering student perceptions of campus climate factors. *Proceedings of the 34th Annual Frontiers in Education.* Brown, A. R., Morning, C., & Watkins, C. (2005). Influence of African American engineering student perceptions of campus climate on graduation rates. *Journal of Engineering Education*, *94*(2), 263–271.

Burt, B. A., & McKen, A. S., & Burkhart, J. A., & Hormell, J., & Knight, A. J. (2016). Racial microaggressions within the advisor-advisee relationship: Implications for engineering research, policy, and practice. *Proceedings of the ASEE Annual Conference & Exposition*. https://doi.org/10.18260/p.26029

Burt, B. A., McKen, A., Burkhart, J., Hormell, J., & Knight, A. (2019). Black men in engineering graduate education: Experiencing and coping with racial microaggressions within the advisor-advisee relationship. *Journal of Negro Education, 88*(4), 493–508.

Ceylan, T., & Lee, L. W. (2003*).* Critical thinking and engineering education. *Proceedings of the ASEE Conference and Exposition*.

Crenshaw, K., Gotanda, N., Peller, G., & Thomas, K. (Eds.) (1995). *Critical race theory: The key writings that formed the movement*. New York, NY: Free Press.

Delgado, R., & Stefancic, J. (2017). *Critical race theory: An introduction* (Vol. 20). New York, NY: NYU Press.

Gunnink, B., & Bernhardt, K. S. (2002). *Writing, critical thinking, and engineering curricula*. Paper presented at the 32nd Annual Frontiers in Education Conference, Boston, MA.

Harden, K. & Harden-Moore, T. (2017). Moving from ally to accomplice: How far are you willing to go to disrupt racism in the workplace? *Diverse Issues in Higher Education*. Retrieved from https://diverseeducation.com/article/138623/

Harper, S. R. (2010). An antiÐdeficit achievement framework for research on students of color in STEM. *New Directions for Institutional Research, 2010*(148), 63–74.

Harper, S. R. (2012). Race without racism: How higher education researchers minimize racist institutional norms. *The Review of Higher Education, 36*(1), 9–29.

Kendi, I. X. (2016, November 17). *2016 National Book Awards - Ibram X. Kendi (Full)* [Video file]. Retrieved from https://www.youtube.com/watch?v=aTnCkW4aCMQ

Kendi, I. X. (2019). *How to be an anti-racist*. New York, NY: One World.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, *32*(3), 465–491.

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: AKA the remix. *Harvard Educational Review, 84*(1), 74–84.

Ladson-Billings, G. & Tate, W. (1995). Toward a critical race theory of education. *Teachers College Record, 97*, 47–68.

Long, L. L., III. (2019a). *Using active learning and the Wright State Model for Engineering Mathematics Education to cultivate academic success among first-year engineering students*. Paper presented at the ASEE Southeastern Section Annual Conference, Raleigh, NC.

Long, L. L., III. (2019b). Using more frequent and formative assessment when replicating the Wright State Model for Engineering Mathematics Education. *Proceedings of the ASEE Annual Conference & Exposition.*

Long, L. L., Henderson, T. S., & Williams, M. S. (2018). Institutional barriers to Black and Latino male collegians' success in engineering and related STEM fields. *Proceedings of the ASEE Annual Conference & Exposition.* Retrieved from https://peer.asee.org/30673

Long , L. L., III, & Mejia, J. A. (2016). Conversations about diversity: Institutional barriers for underrepresented engineering students. *The Journal of Engineering Education, 105*(2), 211–218.

Long , L. L., III, & Sun, L. (2018). Entrepreneurial mindset: Integrating creative thinking and innovation into a graphical communications course. *The Engineering Design Graphics Journal, 82*(2), 58–63.

McGee, E. O. (2020). Interrogating structural racism in STEM higher education. [Manuscript accepted with minor revisions]. *Educational Researcher*.

McGee, E. O., Griffith, D. M., & Houston, S. (2019). "I know I have to work twice as hard and hope that makes me good enough": Exploring the stress and strain of Black doctoral students in engineering and computing. *Teachers College Record. 121*(4), 1–38. Retrieved from http://www.tcrecord.org/Content.asp?ContentId=22610

McGee, E. O., & Martin, D. B. (2011). "You would not believe what I have to go through to prove my intellectual value!" Stereotype management among academically successful Black mathematics and engineering students. *American Educational Research Journal*, *48*(6), 1347–1389.

McGee, E. O., & Robinson, W. H. (2019). *Diversifying STEM: Multidisciplinary perspectives on race and gender*. New Brunswick, NJ: Rutgers University Press. Retrieved from https://www.rutgersuniversitypress.org/diversifying-stem/9781978805675

Moore, J. L., III, Madison-Colmore, O., & Smith, D. M. (2003). The prove-them-wrong syndrome: Voices from unheard African-American males in engineering disciplines. *The Journal of Men's Studies, 12*(1), 61–73.

Pawley, A. L., Mejia, J. A., & Revelo, R. A. (2018). Translating theory on color-blind racism to an engineering education context: Illustrations from the field of engineering education. *Proceedings of the* ASEE Annual Conference & Exposition. Retrieved from https://peer.asee.org/31161

Provenzo, E. F., Shaver, A. N., & Bello, M. (Eds.). (2011). *The textbook as discourse: Sociocultural dimensions of American schoolbooks*. New York, NY: Routledge. http://dx.doi.org/10.4324/9780203836026

Rankins, C. (2019). *HBCUs and Black STEM Student Success*. Washington, DC: Association of American Colleges & Universities. Retrieved from https://www.aacu.org/peerreview/2019/winter-spring/Rankins

Savage, G. (2017). Researchers seek key to success of STEM students at HBCUs. *Diverse Issues in Higher Education*. Retrieved from http://diverseeducation.com/article/100576/

Siller, T. J. (2001). Sustainability and critical thinking in civil engineering curriculum. *Journal of Professional Issues in Engineering Education and Practice, 127*(3), 104–108.

Strayhorn, T. L., Long, L. L., III, Kitchen, J. A., Williams, M. S., & Stentz, M. (2013). Academic and social barriers to Black and Latino male collegians' success in engineering and related STEM fields. *Proceedings of the ASEE Annual Conference & Exposition*. Retrieved from https://peer.asee.org/19146

Williams, P. J. (1998). *Seeing a color-blind future: The paradox of race*. New York, NY: Farrar, Straus & Giroux.

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