



Introduction to the Special Theme on Responding to Anti-Blackness in Science, Mathematics, Technology and STEM Education

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The COVID-19 pandemic has provided yet more evidence of the impacts of injustice across intersecting raced, gendered and classed lines. For Black people, the pandemic is further exposing the brutal effect of ongoing systemic health inequities (Etowa & Hyman, 2021). At the same time, an intensified global uprising against anti-Black violence in response to the murders of Breonna Taylor, Ahmaud Arbery and George Floyd has amplified a reckoning with the ongoing effects of the “global state of emergency of anti-Blackness” (Brand, 2020, para. 1) in all of its enduring forms and violences. The current time of reckoning has inspired an interrogation of anti-Blackness in the sciences, such as seen in the emergence of social media movements and communities such as #BlackinNeuro and #ShutDownSTEM (Chen, 2020; Ortolano, 2020). Inspired by the disruptive potentialities of the current moment, the articles in this Special Theme offer considerations of possibilities for science, mathematics, technology and STEM education to become sites of liberatory practices and conceptual orientations that act to disrupt anti-Blackness.

Anti-Blackness, “part and parcel of racial slavery and its afterlife, remains the extreme antisocial condition of possibility of the modern social world” (Costa Vargas & Jung, 2021, p. 4). We begin this Special Theme by naming anti-Blackness to underline that a critical part of responding to the current moment is addressing anti-Blackness — a response that is distinct from a generalized anti-racist response. Costa Vargas and Jung (2021) provide a helpful conceptualization of anti-Blackness:

A framework of antiblackness stresses the uniqueness of Black positionality and experiences relative to those of nonblack social groups. It proposes that the defining antagonism of modernity is Black-nonblack (Wilderson, 2010). Deriving from theoretical efforts and historical and sociological analyses, such a perspective suggests that Black people (a) are not only exceptionally and systematically excluded socially—from housing markets, quality education, effective health care, safety, and life—but (b) are the nonbeing that underpins and engenders modern nonblack

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subjectivities. These propositions assume a logic of social and ontological abjection, rather than domination or subjection, of Black people. Such logic is antiblackness. (pp. 7–8)

There is a growing body of scholarship in education that has engaged anti-Blackness as a framework to interrogate the ways in which schooling remains a site of suffering and marginalization for Black children and youth (Dumas & ross, 2016; Nxumalo & ross, 2019; Warren, 2021). This includes work that has shown that science, mathematics, technology and STEM education is a site at which the logics of anti-Blackness persist (Bullock, 2017; Cedillo, 2018; Martin et al., 2019; Vakil & Ayers, 2019).

The cumulative effects of anti-Blackness in science, mathematics, technology and STEM spaces are felt in many ways. They are felt in the under-representation of Black students in STEM fields (Morton et al., 2019; Riegle-Crumb et al., 2019). They are also felt in technology-related STEM fields such as computer science education, where anti-Blackness manifests through persistent opportunity gaps for Black students with respect to a lack of access to technology and advanced courses (Madkins et al., 2020).

In mathematics classrooms, Martin and colleagues (2019) have pointed to the ways in which symbolic and epistemic anti-Black violence persists through the normalization of racialized discourses of achievement gaps; through curricular expressions that situate mathematics as belonging to white and Asian males; through anti-Black tracking practices; and through anti-Black curriculum examples. Epistemic violence extends beyond mathematics environments and includes the ways in which non-Eurowestern scientific epistemologies are continuously marginalized or completely erased (Bang & Medin, 2010). In this regard, science, mathematics, technology and STEM education perpetuates both anti-Blackness and coloniality (Vakil & Ayers, 2019; Warren et al., 2020). Anti-Blackness can also take subtle forms — including those disguised as progressive. For instance, an emphasized focus on historic Black figures in engineering education not only erases ongoing participation and achievements of Black people in engineering, but also it can contribute to a discourse of Black success in the field as an exception rather than a norm (Holly, 2020).

Anti-Black logics persist despite equity, diversity and inclusion initiatives in science, mathematics, technology and STEM classrooms (McGee et al., 2021). For example, despite inclusion-oriented reforms, mathematics classrooms continue to be spaces of non-belonging for Black students, such as seen when inclusion is assimilative and does little to disruptive dominant mathematics education cultures (Martin, 2019). Similarly, initiatives such as placing STEM academies in failing urban schools have been shown to exacerbate racialized educational inequity and to contribute to the displacement of Black students; upholding exclusionary meritocratic processes; and constructing and maintaining STEM education as white property (Bullock, 2017). This is not to suggest that efforts at inclusion are necessarily bad. On the contrary, as illustrated by the articles in this issue, inclusion has transformative potential. Nonetheless, it is important to complicate uncritical discourses of inclusion in STEM-related fields. This includes pointing to the tensions inherent in including Black students into STEM fields that nourish planetary extractivism, militarism and racial capitalism (Nxumalo & ross, 2019; Vakil & Ayers, 2019; Vossoughi & Vakil, 2018).

There are too many examples that we could use to discuss the ways in which anti-Blackness persists and emerges anew in science, mathematics, technology and STEM educational contexts. In this issue, working with an orientation that takes seriously the limits of effecting change by focusing on and circulating stories of harm (Tuck, 2009), we are interested in the possibilities for transformation of unjust power relations. The papers in the Special Theme collectively respond to the question of what refusals of anti-Blackness and conceptualizations of otherwise Black futures might entail in doing and thinking science, mathematics, technology and STEM differently. In the call for this Theme, we were particularly interested in the possibilities for education to be a site of building and imagining Black futurity (Nxumalo, *in press*; Warren, 2021). This is resonant with our opening discussion of the disproportionate impacts of the pandemic and a global reckoning with anti-Black violence which together point to the current moment of reckoning as one filled with potential for

transformation in breaking from current systems and practices that have normalized anti-Blackness, individualism and unsustainable, extractive ways of living with the natural world, among other injustices (Bang, 2020; Benjamin, 2020). As Canadian poet Dionne Brand (2020) has powerfully stated, now is a time to refuse a return to an “awful normal that is narrativized as minor injustices” (para. 2).

The justice-oriented approaches that are taken up by the articles in this Special Theme in response to the impetus of the current moment are varied and include a focus on curriculum and pedagogy, equity- and inclusion-oriented initiatives, and conceptual responses to anti-Blackness. In addition, within the overall framing of a focus on responding to anti-Blackness, the articles put to work multiple theoretical orientations including Critical Race Theory (Burke et al., 2021); political clarity (Madkins & Morton, 2021); hauntology (Motala & Stewart, 2021); and BlackCrit (Jones & melo, 2021). This multiplicity of perspectives and approaches is important — anti-Blackness emerges in complex ways and at multiple scales in specific science, mathematics, technology and STEM education contexts. Anti-Blackness is “mercurial innovative, even viral ... [it]distorts reality, interpersonally and institutionally” (Benjamin, 2020, para. 12–13). Anti-Blackness continuously takes on new forms, including those under the cover of “progress” and inclusion and therefore requires multiple situated, creative and imaginative and Black future-oriented responses.

We also want to note here that STEM is taken up in multiple and expansive ways in this Special Theme. This includes engaging with STEM to gesture to one of the disciplines, such as science, computer science, engineering, mathematics and medicine. It also includes a broader interdisciplinary use of the term STEM to refer to the field of science-related disciplines. The authors also take up STEM to refer to integration of multiple STEM disciplines within K-12 schooling. These varied engagements underline the social, political and cultural situatedness of the complex landscape of STEM education. Meanings of STEM and STEM education are taken up in ways that disrupt universalizing, decontextualized approaches that separate out epistemology from ontology and that claim a transcendent “objective” view from nowhere (Haraway, 2003; Motala & Stewart, 2021; Vakil & Ayers, 2019).

The articles in this Special Theme also enact situated engagements with Black subjectivity. While anti-Blackness is a necessary and important framework for understanding the manifestation of dehumanizing and exclusionary systems and practices in multiple contexts for those collectively racialized as Black, this is not to assume a monolithic conception of Blackness. For instance, in their article in this Special Theme, Madkins and Morton (2021) point out that it is important to attend to the ways in which ethnic identity matters for how students experience Blackness and anti-Blackness. Madkins and Morton discuss that, within the context of their work in the USA, this includes attuning to the specificities of students who may identify as Black American, Afro-Latinx, Afro-Indigenous, Caribbean and immigrants from African nations, among many other markers of ethnic identity. The articles in this issue collectively attend to the situated complexities of Black subjectivity within and across the limits of nation states including but not limited to Black Canadian medical students (Saddler et al., 2021), Black South African and Canadian engineering university students (Burke et al., 2021; Motala & Stewart, 2021), and within the USA, Black students in computer science (Jones & melo, 2021). Importantly, Black subjectivity is understood as continuously in motion; as emplaced processes of negotiation in relation to histories, discourses, particular intersectional experiences in STEM and related disciplines, and more (Wright, 2004).

Taken together, the five articles in this Special Theme take up multiple vantage points from which to be affected by, notice and respond to anti-Blackness, including possibilities for participation in science, mathematics, technology and STEM education to align with liberatory, abolitionist and equity-oriented commitments that interrupt oppressive structures.

We begin with Jones’ and melo’s (2021) paper, which is situated within the context of computer science education in the USA, also puts forward liberatory possibilities. The authors powerfully engage

speculative fiction to do the work of making visible the anti-Blackness that is embedded in computer science and to imagine abolitionist, anti-colonial and reparative possibilities. With inspiration from Ruha Benjamin (2016), their work simultaneously names the workings of anti-Blackness in computer science education *and* enacts speculative storytelling that “reimagine[s] and rework[s] all that is taken for granted about the current structure of the social world” (p. 2). Drawing from their own experiences with anti-Black racism in computer science education, Jones and Melo offer affective, embodied and situated tellings of what it might look like for Black students to not only survive the conditions of anti-Blackness in computer science education, but also to thrive in the midst of Black Joy. Importantly, Jones’ and Melo articulate a vision for computer science education and related technological creations that support sustainable rather than extractive relations with earth: a critical orientation for current times of anthropogenic planetary damage.

Madkins and Morton (2021) focus on possibilities for interrupting anti-Blackness and coloniality in engaging possibilities for otherwise pedagogies in elementary STEM teacher education. This Special Theme paper is grounded in a pedagogical commitment of political clarity that requires teacher candidates to commit to deep understandings of the workings and impacts of structural and school inequities. Madkins and Morton offer powerful concrete strategies that teacher candidates can use to center Black and Indigenous lived realities and to foreground social justice approaches. These strategies, designed to disrupt anti-Blackness, include specific classroom design features; participation structures such as methods for centering students’ shifting cultural practices and lived experiences; and modes of making explicit connections between STEM content and social injustice. Importantly, this paper offers ways for teachers to counter dominant discourses of non-belonging for young Black and Indigenous STEM learners.

Moving to post-secondary contexts, Motala and Stewart (2021) in “Hauntings across the Divide: Transdisciplinary Activism, Dualisms, and the Ghosts of Racism in Engineering and Humanities Education” also engage in possibilities for otherwise pedagogical commitments that disrupt anti-Blackness and coloniality. Working from the contexts of South Africa and the USA, they story the interruptive possibilities that emerged when university engineering students in a Geographic Information Systems course in South Africa engaged in learning with students in a writing class in the USA using WhatsApp chat groups to collaborate. Engaging with diffractive posthumanist analyses of course dialogues and artifacts, the authors show both the potentialities of transdisciplinary and transnational engineering pedagogies. Thinking with the concept of hauntology, the authors also make visible the challenges of enacting transformative pedagogies amidst enduring global anti-Blackness, colonial dualisms and anti-Muslim racism.

Burke et al. (2021) also address the engineering discipline. Their paper is focused on efforts to address anti-Blackness at the University of Toronto’s Faculty of Applied Science and Engineering (U of T FASE). These multifaceted initiatives include K-12 outreach, race-based data collection and the creation of openings for race-centered learning. Using Critical Race Theory and personal narratives, the article underlines the challenges of shifting anti-Blackness amidst ongoing barriers such as the lack of institutional financial commitments towards sustaining community-focused outreach initiatives, unwillingness to make visible and confront whiteness in engineering at U of T FASE, and the persistence of meritocratic discourses in engineering. While acknowledging the complexity of addressing these barriers, the authors offer important ways forward for this important ongoing work. For example, they discuss the importance of sustained institutional support for the work of the Engineering Student Outreach Office to continue to identify and engage with community partners that can, in turn, offer support to Black students. This work also underlines the urgency of accelerating collection and action with respect to race-based data by engineering faculties in Canada. As noted in the article, the relative lack of race-based data collection is a significant barrier that extends beyond the University of Toronto to all Canadian post-secondary institutions.

Saddler and colleagues' (2021) paper is also concerned with issues of anti-Black exclusion at the University of Toronto; specifically, at the Temerty Faculty of Medicine. Underlining the effects of systemic racism in healthcare institutions on health outcomes for Black communities in Canada, the authors point to patient-physician racial concordance as one important area of focus in attending to health inequities in Black communities. In beginning to address the urgent need for Black physicians in Canada, the paper describes recent initiatives at University of Toronto's Temerty Faculty of Medicine; namely mentorship programs that work in relation with a Black Student Application Program. The authors discuss the success of these programs, not only in increasing Black medical student representation, but also in relation to impacts on surrounding Black communities. The Application program facilitates the involvement of Greater Toronto Black communities within and beyond healthcare fields in the support of the admissions process for Black students. Importantly, the authors underline that inclusion of Black applicants into medical fields is only one necessary step — they discuss, for instance, ongoing work to address issues of equity and anti-Black racism in medical school curriculum and ongoing work to support the medical school experiences of Black students. An important part of these efforts is providing Black medical students with outreach opportunities that connect them with Black communities.

One year forward from a global uprising against anti-Blackness, we are still in the midst of “the radical potentialities of this remarkable historical moment...a phoenix of hope carrying newly invigorated Black dreams of freedom and resistance” (ross, 2021, p. 229). Each of the papers engages with the transformative possibilities for this moment within different contexts of science, mathematics, technology and STEM education. While the articles show the persistent challenges of dismantling anti-Black logics, they offer inspiring possibilities for more liberatory Black futures in science, mathematics, technology and STEM education.

Declarations

Conflict of interest The authors declare no competing interests.

References

- Bang, M. (2020). Learning on the move toward just, sustainable, and culturally thriving futures. *Cognition and Instruction*, 38(3), 434–444. <https://doi.org/10.1080/07370008.2020.1777999>
- Bang, M., & Medin, D. (2010). Cultural processes in science education: Supporting the navigation of multiple epistemologies. *Science Education*, 94(6), 1008–1026.
- Benjamin, R. (2016). Racial fictions, biological facts: Expanding the sociological imagination through speculative methods. *Catalyst: Feminism, Theory, Technoscience*, 2(2), 1–28.
- Benjamin, R. (2020, April). Black skin, white masks: Racism, vulnerability & refuting Black pathology. Retrieved from: <https://aas.princeton.edu/news/black-skin-white-masks-racism-vulnerability-refuting-black-pathology>
- Brand, D. (2020, July). *On narrative, reckoning and the calculus of living and dying*. Toronto Star. Retrieved from <https://www.thestar.com/entertainment/books/2020/07/04/dionne-brand-on-narrative-reckoning-and-the-calculus-of-living-and-dying.html>
- Bullock, E. C. (2017). Only STEM can save us? Examining race, place, and STEM education as property, *Educational Studies*, 53(6), 628–641.
- Burke, M., Hanson, C. & Abraham, C. (2021). Addressing Black inclusivity within a Canadian post-secondary engineering faculty: A critical perspective. *Canadian Journal of Science, Mathematics, and Technology Education*. <https://doi.org/10.1007/s42330-021-00155-5>
- Cedillo, S. (2018). Beyond inquiry: Towards the specificity of anti-Blackness studies in STEM education. *Canadian Journal of Science, Mathematics, and Technology Education*, 18, 242–256.
- Chen, S. (2020, June). *Researchers around the world prepare to #ShutDownSTEM and 'Strike For Black Lives'*. Retrieved from: <https://www.sciencemag.org/news/2020/06/researchers-around-world-prepare-shutdownstem-and-strike-black-lives>

- Costa Vargas, J. H. & Jung, M-K. (2021). Introduction: Antiracism of the social and the human. In Jung, M-K & J.H. Costa (Eds.), *Antiracism* (pp. 1–14). Duke University Press.
- Dumas, M. J., & ross, k. m. (2016). “Be real Black for me”: Imagining BlackCrit in education. *Urban Education*, 51(4), 415–442.
- Etowa, J. & Hyman, I. (2021). Unpacking the health and social consequences of COVID-19 through a race, migration and gender lens. *Canadian Journal of Public Health*, 112(1), 8–11. <https://doi.org/10.17269/s41997-020-00456-6>
- Haraway, D. (2003). Situated knowledges: The science question in feminism and the privilege of partial perspective. In Y. S. Lincoln & N. K. Denzin (Eds.) *Turning points in qualitative research: Tying knots in a handkerchief* (pp.21–46). Lanham: Altamira Press,
- Holly, J. Jr. (2020). Disentangling engineering education research’s anti-Blackness. *Journal of Engineering Education*, 109(4), 629–635. <https://doi.org/10.1002/jee.20364>
- Jones, S.T. & melo, n.a. (2021). We tell these stories to survive: Towards abolition in computer science education. *Canadian Journal of Science, Mathematics, and Technology Education*. <https://doi.org/10.1007/s42330-021-00158-2>
- Madkins, T.C. & Morton, K. (2021). Disrupting anti-Blackness with young learners in STEM: strategies for elementary science and math teacher education. *Canadian Journal of Science, Mathematics, and Technology Education*. <https://doi.org/10.1007/s42330-021-00159-1>
- Madkins, T. C., Howard, N. R., & Freed, N. (2020). Engaging Equity Pedagogies in Computer Science Learning Environments. *Journal of Computer Science Integration*, 3(2), 1–27.
- Martin, D. B. (2019). Equity, inclusion, and antiracism in mathematics education. *Race Ethnicity and Education*, 22(4), 459–478.
- Martin, D. B., Price, P. G., & Moore, R. (2019). Refusing systemic violence against Black children: Toward a Black liberatory mathematics education. In J. Davis & C.C. Jett (Eds.), *Critical race theory in mathematics education* (pp. 32–55). Routledge.
- McGee, E. O. Botchway, P. K., Naphan-Kingery, D. E., Brockman, A. J., Houston II, S. & White, D.T. (2021). Racism camouflaged as impostorism and the impact on black STEM doctoral students. *Race Ethnicity and Education*. <https://doi.org/10.1080/13613324.2021.1924137>
- Morton, T. R., Gee, D. S., & Woodson, A. N. (2019). Being vs. becoming: Transcending STEM identity development through Afropessimism, moving toward a Black X consciousness in STEM. *The Journal of Negro Education*, 88(3), 327–342.
- Motala, S. & Stewart, K. (2021). Hauntings across the divide: transdisciplinary activism, dualisms, and the ghosts of racism in engineering and humanities education. *Canadian Journal of Science, Mathematics, and Technology Education*. <https://doi.org/10.1007/s42330-021-00153-7>
- Nxumalo, F. (in press). Disrupting anti-Blackness in early childhood qualitative inquiry: Thinking with Black refusal and Black futurity. *Qualitative Inquiry*.
- Nxumalo, F. & ross, k. m. (2019). Envisioning Black space in environmental education for young children. *Race Ethnicity & Education*, 22(4), 502–524.
- Ortolano, N. (2020, August). ‘We do belong here’: The scientist behind #BlackInNeuro hopes to transform a Twitter movement into a lasting community. Retrieved from: <https://www.statnews.com/2020/08/26/we-do-belong-here-the-scientist-behind-blackinneuro-hopes-to-transform-a-twitter-movement-into-a-lasting-community/>
- Riegle-Crumb, C., King, B., & Irizarry, Y. (2019). Does STEM stand out? Examining racial/ethnic gaps in persistence across postsecondary fields. *Educational Researcher*, 48, 133–144.
- ross, k.m. (2021). Anti-Blackness in education and the possibilities of redress: Toward educational reparations. *Amerikastudien/American Studies*, 66(1), 229–233.
- Saddler, N., Adams, S., Robinson, L. A., & Okafor, I. (2021). Taking initiative in addressing diversity in medicine. *Canadian Journal of Science, Mathematics, and Technology Education*. <https://doi.org/10.1007/s42330-021-00154-6>
- Tuck, E. (2009). Suspending damage: A letter to communities. *Harvard Educational Review*, 79(3), 409–428.
- Vakil, S., & Ayers, R. (2019). The racial politics of STEM education in the USA: Interrogations and explorations. *Race Ethnicity and Education*, 22, 449–458.
- Vossoughi, S., & Vakil, S. (2018). Toward what ends? A critical analysis of militarism, equity, and STEM education. In A.I. Ali & T. L. Buenavista, T. L. (Eds.) *Education at war: The fight for students of color in America’s public schools* (pp. 117–140). Fordham University Press.
- Warren, B., Vossoughi, S., Rosebery, A. S., Bang, M., Taylor, E. V. (2020). Multiple ways of knowing: Re-imagining disciplinary learning. In N.S. Nasir, C.D. Lee, R. Pea & McKinney de Royston, M. (Eds.) *Handbook of the cultural foundations of learning* (pp. 277–293). Routledge.
- Warren, C. A. (2021). From morning to mourning: A meditation on possibility in Black education. *Equity & Excellence in Education*, 54(1), 92–102.
- Wilderson, F.B. III. (2010). Red, White & Black: Cinema and the structure of US antagonisms. Duke University Press.
- Wright, M. M. (2004). *Becoming Black: Creating identity in the African diaspora*. Duke University Press.