



We Tell These Stories to Survive: Towards Abolition in Computer Science Education

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Abstract Computer science (CS) education finds itself at a pivotal moment to reckon with what it means to accept, use, and create technologies, with the continued recruitment of minoritized students into the field. In this paper, we build on the oral traditions of educating with stories, and take the reader on two journeys. We begin with a story that leads us in thinking about where computer science education is, in the wake of slavery, under the New Jim Code. Within a BlackCrit framework, we shake the grounds of the computer science field, where technologies are often promoted as objective, but reflect and reproduce existing inequalities. In tune with maintaining current systems of power, efforts to broaden participation in computer science have been heavily driven by industry, government, and military interests. These interests ultimately push us farther away from sustainable relations with the earth and with each other, and risk the very lives of the same communities the field claims to help. However, we can rewrite the narratives of the role of technology in our lives. We present a second story in which we place abolitionist theories and practices in conversation with computer science education. In this paper we explore (1) In what ways does computing education support systems that enable Black death? and (2) How might integrating an abolitionist framework into computer science open up possibilities for world-building and dreaming in the name of Black Life? We imagine a different future where computer science is used as a tool in life-affirming, world-building projects. We invite readers to engage with this piece as a part of an active dialogue towards combating anti-Black logics in the field of computer science education.

Résumé La formation en informatique se trouve à un moment charnière alors que l'on prend conscience de ce que cela signifie d'intégrer, d'utiliser et de créer des technologies et que l'on continue de recruter des étudiants issus de minorités pour œuvrer dans ce domaine. Dans cet article, nous partons des traditions orales d'enseignement par récits et amenons le lecteur à s'engager sur deux parcours.

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Nous débutons avec un récit qui nous force à réfléchir sur la situation dans laquelle la formation en informatique se trouve dans le sillage de l'esclavage et sous le « nouveau code Jim ». Au sein d'un cadre fondé sur la « théorie critique concernant les Noirs », nous déstabilisons les fondements de l'industrie informatique dans laquelle les technologies sont promues comme étant objectives alors qu'en réalité, elles reflètent et reproduisent les inégalités existantes. En adéquation avec le maintien des systèmes de pouvoir actuels, les efforts instaurés pour élargir l'accès au domaine informatique ont été fortement influencés par des intérêts industriels, gouvernementaux et militaires. Ces intérêts ont pour résultats ultimes de nous empêcher d'établir des relations durables avec la terre et les uns avec les autres en plus de mettre en péril la vie même des communautés que le domaine prétend aider. Cependant, nous pouvons redéfinir le rôle que joue la technologie dans nos vies. Nous présentons un second récit dans lequel les théories et les pratiques abolitionnistes sont insérées dans la conversation entourant la formation en informatique. Dans cet article, nous explorons 1) comment l'enseignement de l'informatique soutient les systèmes qui contribuent à la « mort noire » et 2) comment l'intégration d'un cadre abolitionniste en informatique pourrait donner lieu à des occasions de bâtir et de rêver un monde agissant au nom de la « vie noire ». Nous imaginons un futur différent dans lequel l'informatique devient un outil servant à ériger des projets bâtisseurs axés sur la valeur de la vie. Nous invitons les lecteurs à s'engager dans cette voie dans le cadre d'un dialogue dynamique visant à combattre la logique anti-noire dans le domaine de la formation en informatique.

Keywords Computer science education · Anti-Blackness · BlackCrit · Speculative fiction · Abolition · Black Life

Introduction

In response to the coronavirus pandemic and the need to adapt to a “socially distanced” way of living, 2020 marked a proliferation of technological innovations. Technology, for many, became one of the only ways to connect in a time where we became physically distant. Yet, as progress and innovation narratives gain traction, a healthy suspicion of what can be done with computing is still necessary. For example, our desires for connection were interrupted by targeted “zoom bombings” that aimed to disrupt our relations to one another during physical distancing. The offenders frequently screen shared media of Black people, among other historically minoritized groups, dying, while also calling participants slurs (McKenzie, 2020). The ubiquity and centrality of technology in this moment provided more opportunity for displays of violence and Black suffering. With these acts as a reminder, computer science (CS) education finds itself at a pivotal moment to reckon with what it means to ethically accept, use, and create technologies.

This paper arises out of our experiences within institutions that convince us that we can change the world with technology; but, unless aligned with institutional interests, this change fails to account for the wellbeing of our communities. We begin to unravel the anti-Blackness woven into CS education, despite and alongside efforts to increasingly recruit Black students into computing fields. Anti-Black racism (anti-Blackness) is a particular kind of racism in which Black people are systemically dehumanized (Dumas & ross, 2016). Anti-Blackness is essential to upholding white supremacy and ongoing global colonization. With this in mind, we interrogate computing education's relationship to anti-Blackness as guided by the following questions:

1. In what ways does computing education support systems that enable Black death?
2. How might integrating an abolitionist framework into computer science open up possibilities for world-building and dreaming in the name of Black Life?

To explore these questions, we build on the oral traditions of educating with stories, and take the reader on two journeys. The first journey exposes how neglecting the impact of anti-Black racism in computing leads towards social and physical Black death. Following this, we historicize the dominating ecologies of CS education and build upon scholars who propose equity and justice in the field. We then pose a conversation around abolition as a liberatory act, that draws us beyond survival (Love, 2019), for Black students and communities. During the second journey, we ask you, our reader, to consider what a computing education that took Black Life seriously could look like. We transform the original narrative, dreaming of a computer science education focused on the creation of sustainable life — centring love, healing, and joy. A computer science that takes seriously and values Black Life. One grounded in loving relations, where neither land, human, nor more-than-human is treated as disposable (Bang et al., 2012; Flowers, 2019; Barnard Center for Research on Women, 2014).

Theoretical Framework

We begin from the assumption that anti-Black racism is central to patterns of domination in the United States (U.S.), and its education systems (Bell, 1991). This assumption is core to the theories we draw from and directly leads us to our choice of frameworks: Black Critical Theory (BlackCrit) and abolition. Within and in response to a need in critical race theory (CRT), BlackCrit attends to the particular role of anti-Blackness in maintaining white supremacy (Dumas & ross, 2016). Through the lens of BlackCrit, we see how computing and computing education devalue Black Life, as described throughout our piece. These observations are particularly relevant as local governments ban conversations around critical race theory in schools (Adams, 2021), but continue patterns of anti-Black domination. Inspired by work being done to liberate Black people from the prison-industrial-complex (PIC), we also place abolition in conversation with CS education to begin the transdisciplinary work necessary to upend structures that uphold anti-Black racism.

Through anti-Black racism, individuals who are racialized as Black are separated from the category of human in order to uphold white supremacy (Dumas & ross, 2016). This is a world in which Black social and literal death are essential to maintaining order (Dumas & ross, 2016); the technology and education produced within this world are no exceptions. BlackCrit highlights the ways the “specificity of blackness” in the educational system surfaces racialized harm against Black students, including more punitive forms of discipline (Dumas & ross, 2016). BlackCrit does not claim an essentialist Black experience across class, gender, and sexuality, but rather intervenes in “how policies and practices find their logic in, and reproduce Black Suffering” (Dumas & ross, 2016, p. 429). BlackCrit informs both stories we tell centred around the fictional character Shanel, a Black undergraduate student studying computer science. Our first story exposes anti-Blackness in computer science education, and the second dreams a “Black liberatory fantasy” (Dumas, 2018) in which Blackness is honored, valued, and indispensable.

BlackCrit puts in perspective how CS education, through a neoliberal imaginary, calls for Black people to enter into the computing industry; simultaneously, this requires turning an eye to ongoing harm inflicted on Black communities and amplified through technologies. This harm maintains the New Jim Code (Benjamin, 2019). Benjamin puts forward to help us move beyond objectivity in computing and see how technologies reflect and reproduce already existing inequities. Smart speakers, for example, not only stream music but are built with alert systems that directly contact “emergency services,” such as the police, to ensure a sense of “safety.” Yet, we arrive at a paradox, as Black women often experience violence from police at home, as we saw with Breonna Taylor (Smith, 2021). Thus, advances in technology are deeply entangled with surveillance and policing systems — consistent with the Jim Crow era (Browne, 2015) — that are complicit in, and enact, violence.

Extending BlackCrit, we join abolitionists to strategize for the future of a computing education that supports Black Joy rather than suffering. Abolition is one way in which people have historically and presently battled anti-Blackness. Abolitionist theories have been tied to a deep interrogation of the PIC, or “the overlapping interests of government and industry that use surveillance, policing, and imprisonment as solutions to economic, social and political problems” (Critical Resistance, 2021, p. 1). Abolitionists seek to understand and address the systems that cause conditions for harm, through dismantling what causes harm and building what cultivates more life. As we explore the life of Shanel, we reveal how the web of control and punishment — and, ultimately, disposability — extend into every facet of her existence. We explore what computing education could look like in the process of abolition, in a world where communities are provided the necessary resources and support to care for all their inhabitants. Alongside other scholars of education, we see abolition as a disrupter to processes of schooling that dehumanize Black students and that cause ideological suffering (Stovall, 2018; Shange, 2019; Love, 2019). We understand learning as a social, relational, and political endeavour in which our ecologies guide our understanding of the world (Vygotsky, 1978; Lee, 2001; Esmonde & Booker, 2017). This view shapes the ways we see abolition as disrupting anti-Black practices within computing education. By emphasizing abolition in our relationships to one another, we imagine and create futures that honour Black life, not just in regard to classroom learning, but beyond.

On Method

We place ourselves in an ancestral tradition of using storytelling to communicate history, meaning, and futures (Christian, 1988; Nxumalo & ross, 2019; Wenner-Gren Foundation, 2021). Shanel’s stories are both created through our own experiences to illuminate pasts and futures; the first fictional story makes meaning of what is and has been, and the second speculative, is a portal towards new possibilities, where we might “expand our visions of what is possible” (Benjamin, 2016, p. 2), in a way that can hold Black Life (Nxumalo & ross, 2019). Speculative fictions “are not falsehoods but refashionings through which analysts experiment with different scenarios, trajectories, and reversals, elaborating new values and testing different possibilities for creating more just and equitable societies” (Benjamin, 2016, p. 2). Moreover, having experienced anti-Black racism, we share these stories to survive. Barbara Christian (1988) explains this clearly:

For people of color have always theorized - but in forms quite different from the Western form of abstract logic. And I am inclined to say that our theorizing (and I intentionally use the verb rather than the noun) is often in narrative forms, in the stories we create, in riddles and proverbs, in the play with language, because dynamic rather than fixed ideas seem more to our liking. How else have we managed to survive with such spiritedness the assault on our bodies, social institutions, countries, our very humanity? (p. 68)

Thus, our theorizing in this paper is guided by story, contextualizing CS education in the wake of slavery and ongoing coloniality, from which it is not divorced (Sharpe, 2016). We “construct a vision of our reality and preserve our lives in the midst of institutional and often physical erasure” (Toliver, 2020, p. 526). We counter-storytell (Solórzano & Yosso, 2002), portraying different pieces of our and our communities’ experiences through Shanel, to magnify less documented experiences within computing. Through this, we illustrate the subtle yet pervasive ways anti-Blackness integrates into computing education.

We write from land currently known as the United States (U.S.); situated in ongoing histories of colonization, genocide and enslavement of indigenous peoples of many lands, namely those indigenous to Turtle Island and the African continent. One author is the descendant of formerly enslaved cotton sharecroppers in the U.S., born of people of unknown and African diasporic ancestry, understood as

Black. The other Afro-Latinx, a descendant of enslaved Africans in Brazil as well as other unknown ancestry. Our method is informed by our backgrounds and complex relationships with the Americas. Furthermore, both authors pursued and completed undergraduate computing degrees, where our identities often led to feelings of isolation. Shanel's story is grounded in this experience of higher education in predominantly white colleges and touches on our times in high school. These details inform our storytelling, such as in describing Shanel's relationship to her Auntie and contentious 'inclusion' within the university. A different story may have unfolded had we attended other institutions, and we hope to hear other people's stories as a result of this piece. We now come together as PhD students, in a Computer Science and Learning Sciences program, who aim to address our experiences so those who choose computing might be able to flourish.

Unsettling the domination of empirical research, we prioritize a storytelling methodology in computer science education research, affirming our own lives as theory. We invite you to read these stories multiple times, using our following discussions as companion guides. As we enter the first story, we remind you of our first research question: In what ways does computing education support systems that enable Black death?

Auntie Blessings Are What Sustain Us

Shanel is a young Black college student from "the Swamp", a neighborhood inhabitants talk about as a place where murky things thrive. Her family hoped that she would break the surface of their neighborhood by going away to school. Her community wants to be able to breathe better. Between environmental pollution, increased surveillance of their movements, and the intentional defunding of education, it meant a lot that Shanel would become one of those "computing ladies." However, she finds herself entangled in a tug of war between computing and her activism in her third year.

On her way to work, walking past the coffee shops and boutique stores across from campus, Shanel could not help but sigh in frustration. Her sneakers were sadly creased from working in the garden, her shirt untucked from rushing around, and her jacket was probably a size too big — but that was just her personal style. She liked to be comfortable, and wanted mobility to get done what needed to be done. Shanel had stitched her cousin's quote onto the back of the jacket as a reminder for herself and the world. "When you stand up for something, some of us put our lives on the line". Seeing the compost bins by the entrance of the shops, she chuckled. Last year, she and her friends strategically made enough of a fuss that the university agreed to add options for composting all over campus. Even now, she was brainstorming how to establish food based partnerships with local shelters on her way to work. Having grown up in a community similar to that just outside the university, she wanted to utilize her position as a student to voice concerns from the local residents who were situated in a food desert due to ongoing university construction.

Slowly the engineering building, Eli Whitney Hall, came into view. Shanel was nervous about going far away for school but decided to take the risk after her guidance counselor told her she could make enough money to sustain her family members if she majored in a STEM field, at a *good* school. When she was accepted to this university, she was given a full tuition scholarship to study computer science. Though adjusting to the course load was no easy feat, and she still had to get a loan to cover room and board, Shanel managed to do well enough in her first computer science class to earn a paid position as a teaching assistant by her second semester. From that time onwards, she was employed by the computer science department as a tutor to cover room and board expenses. On what should have been a regular work day, Shanel arrived hastily at her station, looked at her computer, and paused, wondering what she was going to do. She had not realized that there would be a time when her role in computing would conflict so directly with her activism.

She had opened an email that revealed the computer science department planned to expand after just three years, when their student enrollment doubled in size. The building committee voted to buy several blocks of the city, including a local park and community garden, as the ideal site for their secondary property. Shanel knew the garden well, as she often turned to that soil as a friend, tending to it as a part of her weekly practices. She started to receive text messages from friends, asking if she was going to pull something again. Shanel felt momentarily hesitant, thinking of her family who had hoped she would graduate and inspire the children in “the Swamp”. While the compost bins had been a risky fight, they did not involve her speaking out against her department head, the person who controlled her education and could prevent her from graduating. None of her computer science courses, not even her CS ethics course, had addressed computer sciences’ relationship to the environment.

After some time, Shanel decided to reach out to the professor she worked for, asking if she could join in on the meeting with the team in charge of expansion. Within the email thread she laid out some potential points she had researched if they did decide to go forward with the expansion. First, she suggested they not only choose a different location, but participate in the land tax program, to send part of their building funds to both local Indigenous communities and Black students as a means of reparations. She also wanted to know about the sustainability of the building materials. After several days had gone by without any acknowledgement of her message, Shanel again reached out to her professor who only responded, “I hear your concerns Shanel, but it’s out of my hands.” She was assured she could continue working in her current building if she felt uncomfortable in the new one.

Frustrated with this response, she went to the garden where she ran into one of her favourite people, an elder in the community whom she referred to as Auntie Miri. Miri was central to one of the last communities of the city that had not yet been displaced by gentrification. Willow trees crinkled at the corner of her eyes, and she was beginning to gray. You could always find Auntie Miri either caring for neighbourhood children while their guardians worked during the day, or tending to the local garden. On this day, Shanel sat to work alongside her, and they began to chat:

Shanel: *Auntie Miri, have you heard?*

Miri: *Mmm?*

Shanel: *About the university. They wanna build right here.*

Miri: *Oh. Mr. Lloyd mention that to me. [Miri hummed.]*

Shanel: *And?*

Miri: *Mmm. Well, I was thinking we’ll really miss this spot. We’ve tended this garden for 22 years now. We always get a good crop.*

Shanel: *I think it’s worth fighting for.*

Miri: *Oh honey, is this really your battle to fight?*

[Shanel closed her eyes, trying to tune out the world to her Auntie’s melody.]

Miri: *I mean, baby, we want you to finish school. We been fighting off the city for a while now, it was only a matter of time.*

Shanel: *But that’s the problem! [Shanel exhaled a loud, frustrated sigh.] Why we always gotta move on the whims of somebody else! We just wanna take care of ourselves. Why is it...*

[Miri smiled and continued humming.]

Shanel: *So you’re not even worried?*

Miri: *Well, I know we sent some letters to that board. Do you know if they got them?*

Shanel: *Do you have a copy? I’ll be at that place tomorrow.*

Miri: *Be wise, love. We don’t want a building here, but we can always build again. If you must do more, we are behind you, but don’t go to your end.*

Miri sang:

*Won't you help to sing
These songs of freedom
'Cause all I ever have
Redemption songs
Redemption songs (Marley, 1980)*

Shanel felt in her heart that she could not just pass this moment, but in her mind she was not sure what was best to do. Feeling supported by her Auntie, she forwarded the news of expansion to the school's student newspaper and city's local newspaper. She coordinated with friends to paste copies of the communities' letters to the board around campus and throughout social media. She had secured a spot at the next meeting, but some professors openly grumbled and expressed agitation that she went outside of the department to spread the news.

After making little progress, Shanel stopped by the computer science building at night with additional stacks of flyers in hand. She planned to cover the building with flyers opposing the expansion; however, she unknowingly triggered the facial recognition security systems on campus. When she returned to her dormitory she saw a message.

At 2:00 AM last evening, a suspect was reported vandalizing the north entrance to the Whitney building, near the CS department. The suspect was identified as a student and the disciplinary office has been notified.

Shanel immediately began to sweat. It seemed odd that a notice would be so quickly sent out given the measures she had taken to go undetected. She left her cellphone in her dorm room and placed her ID in an RFID blocker, so neither of them should have emitted signals. She had heard whispers of the cameras and software evolving to detect faces and identities through makeup, masks, and neutral outfits, but she thought those were just rumors. She thought about what she learned of predictive policing while protesting last summer, where algorithms could notify police preemptively and identify whom they considered suspects for potential crimes. She knew they had her. In the morning, the disciplinary office called her and informed her of her removal from her position immediately and indefinitely.

It was deeply unsettling that the expansion of the department would continue on, however she was in a state of precarity to pay for her access to housing. She knew that, if need be, Auntie Miri had already extended her home, but to be another mouth to feed after she failed to secure their garden? She was not sure if she could stomach the thought. Her friends and family heard about her firing and were collectively able to send her enough cash for a week's worth of food. A university blast went out condemning the "destruction of property" and "threatening nature" of the protesting her ecological justice group had done on campus — reducing her once-lauded campus advocacy to petty acts of defamation. In the meantime, Shanel began a job search in earnest, spending hours looking for employment only for her laptop charger to abruptly break. Without being able to afford to replace it, she knew she was at risk of not finding a job in time for her next housing bill.

Shanel thought about her current trajectory. Soon the food she snuck from events around campus wouldn't be bonus food, but her main meals. The quickness with which her department agreed to fire her put her on rocky terrain. If not for her Auntie, she might soon be a fully unhoused university student. Why was it so easy for her school to potentially send her onto the streets, where she would be further at risk for assault and death?

Under-Examined Anti-Blackness in CS Education

Shanel's story provides us a lens to think about how Black students are dealing with systems that dispose of them, their communities, and the nature around them. All are rendered invisible, and further silenced

by institutional claims to authority. An abolitionist lens reminds us to dissect the underlying harm that led to the outcomes of this. In this section, we model a “critical consciousness” (Freire, 1970) for the field (Jones & melo, 2020) as we attune to the ways in which Shanel’s computer science education and those involved with it embodied anti-Black disposability. We refer to CS education throughout this section in several ways, making a nod to a multifaceted entity in which researchers, policy makers, educators, students, and other stakeholders are invested in. Vakil and Ayers (2019) state that the trajectory of CS education “invoke[s], reinforce[s], reflect[s], and refract[s] anti-Black, settler-colonial, and neoliberal sociopolitical structures and ideologies in society” (p. 454). We highlight this through a bottom-up inspection; beginning with observing the individual spirit and the ways computing education ingrains anti-Black ideologies; ending on observations of a system motivated by political influences that fund and drive computing education trajectories. This includes an analysis of how anti-Blackness in the field kills our spirits, our bodies, and our communities, creating dead learning. As we engage in this, we explore the costs of expanding and broadening the dominant models of computer science as they currently stand. This section concludes with an acknowledgement of the efforts already being done in computing education to resuscitate the “dead”.

Killing Our Spirits

Anti-Black ideologies are pervasive in computing education, dismissing the lived — and ongoing — histories of slavery and white supremacy. When the words “master” and “slave” are still an ordinary part of our computing vocabulary (Eglash, 2007), and when computer scientists at Google declare their excitement for “quantum supremacy” (Arute et al., 2019), CS education fails its students. It dismisses trauma, intergenerational and ongoing, and gives way to acceptance of language based on the premise of computing operating under neutrality. When left unexamined, this malignant language is deemed ordinary. Dismissing Black pain, in other words, becomes a norm disseminated by computing education. Each day Shanel enters into her building, Eli Whitney Hall, named after a man whose legacy was built on furthering the exploitation of her ancestors, preserving slavery as a means of producing more wealth through cotton (History.com Editors, 2019). Looking broadly in education, we consider this part of the spirit murdering (Love, 2019) that happens in schools, often predicated on the language of teachers and textbooks (Du Bois, 1935). Language signals whose learning is valued as seen here with technical language that reproduces Black suffering as an optimal model of control. We make this claim in urgency, as Black children are spiritually, emotionally, and physically abused by systems daily, in and out the classroom.

Killing Our Bodies

As a consequence of the inattention to language, as well as history, Black death is further manufactured through technology (and technologists). This leads us towards examining the use of surveillance technologies within our story. Within the U.S., the legacy of surveillance dates back to the contexts of slave patrols and border patrols (Browne, 2015). Both of these practices served — and continue to serve — a system of white supremacy by laying control over what and who were deemed as “property”, i.e. lands and enslaved labourers (Browne, 2015; Dumas & ross, 2016). When Shanel is caught “vandalizing” university property and sent to the disciplinary office, she becomes a victim of an ongoing history of “uncontrolled” Black people who are marked for punishment. If the university could not find Shanel to punish, they would have found someone else. Despite alleged advances in surveillance technologies, facial recognition software continues to misidentify and homogenize Black people (Buolamwini & Gebru, 2018; Benjamin, 2019; Jones & melo, 2020). Any person who matches a facial recognition algorithm’s idea of a human becomes suitable for capture and jailing, turning into another piece of property in the

prison-industrial complex. While claiming more safety for all, there is only protection for some. These particular ideologies of “safety” and “protection” that come with surveillance fail to consider what is being protected: wealth.

Lands are not protected when they are exploited. People are not protected when they are exploited. What *is* protected is (white) power and control. Foundational to capitalism is the exploitation of labour and lands as means of growing capital. In particular, enslaved Africans were historically formulated as racial capital (Robinson, 1983), and when no longer profitable economically and politically, they were released under the guise of freedom. This freedom, however, was placed conditional upon continued labour and stunted by the evolution of the prison-industrial-complex. Shanel had laboured for the computing department for years, yet rather than listening to her and the communities’ concerns for the land, her computing job positioned her as a criminal in her last attempt to be heard. The university endangered Shanel’s life by removing her from her job and steady shelter. Similarly, Timnit Gebru, formerly at Google, was fired for attempting to publish on the dangers of algorithms from which the corporation gains enormous profit (Simonite, 2020). It is in witnessing these stories that we note how often institutions wield their power to dismiss conversations of ethics. The lack of critical attention towards computing’s role in the subjugation of the “other” leads us to affirm that computer science and computing education purposely avoid questions of power (Vakil & Higgs, 2019). In order to move further towards abolition, CS Education must be grounded in the examination of how histories of capitalism and racial hierarchization continue to affect us (Vossoughi & Vakil, 2018). Moving away from profit based on individuals, we examine how CS education shapes agendas for communities.

Killing Our Communities

CS Education must hold suspicions around what the state determines is essential for communities of colour. Before entering the university, Shanel was told by her guidance counselor that computing would be good for her future, convinced that the salary from a computing career would ultimately benefit her and her community. However, as we see in the U.S. and globally, much of STEM (science, technology, engineering, and math) education’s curriculum in public schools is funded, and thus shaped by, the military, government, and industry. CS education’s “need” to expand, via initiatives that bring access to computing for all (Madkins et al., 2020), masks its role in exploiting minoritized communities for land, labour, and resources (Parikh & Sabie, 2021). This leaves notions of “diversity” masked behind politics of representation, where “equity” initiatives are utilized primarily to increase the labour force (Vossoughi & Vakil, 2018; Sengupta-Irving & Vossoughi, 2019).

We grapple with how a neoliberal imaginary claims to support students’ material needs, but holds onto notions of disposability, which work together to harm students and their communities. It comes to no surprise that when Shanel pushed back against the goals of her department, she was deposed from her job. Those making policy decisions around education need to continue to be more mindful about the care of learners, not just what they might do for economies in the future. By focusing on the care, we may learn more about K-12 students’ views on CS education so that guidance counsellors, like Shanel’s, can influence students towards their passions, not just monetary gain. Many of these counsellors rely on reports and data disseminated by organizations highlighting statistics around racial and gender diversity in K-12 and Higher Education (Code.org, CSTA, & ECEP Alliance, 2020; National Science Foundation, 2017). It is time to specify in these reports how organizations and schools are moving beyond the broad language of equity and bias, towards explicit mention of how they are combating racism and anti-Blackness. Surpassing these reports, knowing what is at stake, educators and researchers are making strides to change historical ecologies of CS education.

Resuscitating the Dead

Through our critiques of CS education, we recognize the need to be strategic, earnestly tending to current students while still pushing the field. In the ongoing work towards just futures, we acknowledge efforts to interrupt harms in CS education. We begin by considering how equity pedagogies are presented to teachers and researchers. Equity pedagogies, such as Culturally Relevant Pedagogy (Ladson-Billings, 1995) and Culturally Responsive Computing (Scott et al., 2015), have centred socio-historical experiences of minoritized communities within CS education curriculum and teaching practices. These asset-based approaches draw on students' community cultural wealth (Yosso, 2014), and have been shown to have a positive impact on Black youth (Scott & White, 2013; Pinkard et al., 2017). Equity pedagogies can be positioned as part of a call to deprioritize the white and male epistemologies that dominate computer science education (Rodriguez & Lehman, 2017). They instead focus on identity development and personal connections to technology, and position minoritized students as creative agents/change agents (Madkins et al., 2020). Equity pedagogies can be strategic in moving towards joyful learning for students in CS education. However, we wonder if the application of equity pedagogies suggests that the values, identities, and beliefs of minoritized communities can thrive alongside those of a white supremacist society. That is, rather than transforming what power structures stand, professionals who take up equity pedagogies may still assume the permanence of anti-Blackness as a viable thought.

Practiced within some implementations of equity pedagogies, scholars have advocated for an explicit engagement with critical pedagogies in computing education (Vakil, 2014; Lee & Soep, 2016; Van Wart, 2019). These pedagogies draw on critical education theorists such as Paulo Freire and Henry Giroux, and work to build on students' "critical consciousness" (Freire, 1970). This work has opened up opportunities for students like us to examine computing from alternate lenses and create projects that are consequential to us and our communities. However, we are concerned that by developing the critical consciousness of students alone, those in power rest easy after miniscule, if any, systemic change. A move towards abolition will require decentring individualist responsibility and urging societal transformation. We need embodied abolition to be able to transform the systemic conditions that allow for anti-Blackness to persist.

It is helpful to reflect on current system level frameworks as we move towards just futures. The structural resistance and agency (SRA) framework, for example, provides actions that work towards much of what we hope for — ecological justice, disrupting eurocentric hegemonies, and engaging in transdisciplinary work (Akom et al., 2013). However, we grapple with SRA's emphasis on minoritized students in STEM career pathways, and invite us all to consider "towards what ends" we explore STEM (Tuck & Yang, 2018; Vossoughi & Vakil, 2018). This narrative fits as a part of a strategy of fulfilling students' survival, but we assert that a focus towards career is not enough. With this paper, we hope to move from this resistance for survival to a longer-term resistance for liberation, one that is "emancipatory" and for self-determination, ultimately "allow[ing] us to live out our full humanity" (Ward, 2018, p. 108). Thus, in the following section, we are working to reject limitations on our imaginations of what solidarity and action can do. Though we cannot deny material needs and why some students choose to participate in CS, we dream and build towards our freedom. A CS education grounded in abolition — one that cares for its students — must tend to "the needs, capacities, values, identities, and possible futures of underrepresented students and communities" (Vossoughi & Vakil, 2018, p. 133).

Conjuring Abolition in CS Ed

With love as our praxis, we switch gears, generating a new story for Shanel that allows her to not just survive, but thrive. Inspired by abolition efforts across time, and recognizing this as parallel to other

freedom movements, we ground this rewrite with the principles of reducing harm and building sustainable infrastructures for supporting Life. Organizers and organizations, such as Critical Resistance (2020) and Project Nia (2020), offer resources on building our abolitionist toolkits for futures that centre transformative and redistributive justice. These tools tackle root causes of harm by addressing power and privilege, all in service of trying to secure safety and healing for the community. Such an approach is utilized against systems that perpetuate anti-Blackness, such as the prison-industrial-complex and the education system. We thus imagine what CS education's role could be within this movement towards liberation.

To this end, we present prompts for the CS education community to reflect on and consider as actions moving towards abolition. This is by no means a comprehensive list, though we hope it is a step forward. We present possibilities of what can be cultivated through learning from and with each other, especially Black people, though all are harmed by the perpetuation of anti-Blackness. *Conjuring* and *storying* abolition connects us to the work of our ancestors, who as part of their dreaming work, prayed and organized in fields, at rivers, in churches, and other places of worship in order to bring about revolution. In our prior section, we discuss the ways in which dominant CS education is killing and moving towards Black death. Through the metaphor of *conjuring*, we wake and revive computer science education to bring about more Black Life.

Reviving the Dead

Engaging in abolition is one of the ways in which we achieve an ethic of love. Love is a practice, “a form of sweet labor: fierce, bloody, imperfect, and life-giving—a choice we make over and over again” (Kaur, 2020, p. xv–xvi). In rewriting Shanel's story, we conceive a future that *loves* Black Life. This involves unlearning and countering anti-Black practices and ideologies in CS education, and decentring anti-Black practices of policing, surveillance, and disposability. We strive to abolish the hierarchies within our system that place human above land, human above human, and human above the other. In moving towards liberation, we must sit with the ways we may have taken up anti-Black and colonial philosophies, as shaped by learning in systems rooted in white supremacy and settler-colonialism. A focus on healing sustains us. We want to heal the wounds, those that disconnect us from our relations with the natural world and with each other. This is the work of reviving the dead, where we speak Life into CS education by unlearning and dismantling manifestations of anti-Blackness, as well as emphasizing learning, building, and sustaining opportunities for bringing forward Life. Through holding ourselves accountable, strategizing laterally, tending to our collective(s), and committing to action, we begin our way forward.

Holding Ourselves Accountable

In whatever way we engage with computing education, we must consider what systems we are upholding and what new learning we are making space for. We are all (un)learners; this section prompts us to reflect on how we have been complicit in upholding systems of oppression, and to consider what ideologies we prioritize in our work. Particularly within CS education, we must push beyond the ideology that learning environments are “neutral” (Esmonde & Booker, 2017; Benjamin, 2019). Computing education and the systems that influence it are neither neutral nor objective. If you are a teacher, consider how you prioritize the well-being of students in your curriculum and in your advocacy. If the faculty in Shanel's department had advocated on her and her communities' behalf earlier, they would have disrupted the university power hierarchy that silenced people due to their lack of assimilation.

We call for a systemic re/evaluation, pushing beyond the need for assimilation into (white, settler) computing cultures, instead interrogating the questions of why, for whom, and towards what ends one practices their work in computing (Tuck & Yang, 2018; Philip et al., 2018; Vossoughi & Vakil, 2018).

A critical examination affords us the lens to see how institutions (industries, government, military, etc.) often prioritize growing profit, and power, over the people they claim to serve. This lens also gives us a chance to see how minoritized individuals often join the computing field not by interest alone but by necessity. In other words, Shanel's dreams of pursuing CS were rooted in a desire to also redistribute the privileges (monetary, social, and more) afforded by a computing degree to her communities. Imagine what would change if her community already had those resources. When thinking through and building on curriculum, research, and even our moment-to-moment interactions, we must critically examine the ways in which we un/knowingly manifest anti-Blackness (Washington, 2020).

We invite you to pause and reflect: In your practice, how can your language, and actions, allow for interrogating and upending systems of power? What structures are in place to listen to those most harmed from these systems? How can we not only utilize our privilege to redistribute resources, but also question and counter why we have that privilege in the first place?

Strategizing Laterally

Multiple insights and lenses are required to dismantle anti-Blackness. We thus broaden and expand who is considered within the computer science education community and hold *all* of our community members' knowledge as necessary. We push for shared thinking as lateral care and as a counter force to state violence (Sharpe, 2016). Rather than moving from a sense of hierarchy, we act from the principles of participatory democracy where we engage in horizontal decision-making (Mueller, 2004). That is, in deciding futures for CS education, we will need to have conversations across stakeholders; from those who create to those most harmed by technologies. We not only learn alongside our own lived experiences, but with those outside of this field, outside of academia. Like Shanel, we learn from our Aunties, from the curious elders and children around us, and from those we fight for presently held captive within the prison-industrial-complex. We want to strategize so that our computing learning has a positive impact for many people.

To fully engage in lateral conversation, we also focus on embracing multiple epistemologies (ways of knowing) about how we can relate to this world (Bang & Medin, 2010; Bang et al., 2012). Here, we also bring attention to a trend in hierarchy between STEM and “non-STEM” learning where certain learning is not ideologically counted as STEM, and other learning is only valuable as it progresses institutions. We advocate for strategizing around CS learning not only with BlackCrit, but also Queer Theory (Paré, in press, 2021), Indigenous knowledge systems (Sandoval, 2017), and other transformative views. In working together, while attending to our specificities, we conjure liberatory futures.

Thus, we invite you to pause and reflect: What forms of knowledge do you prioritize as legitimate and why? How do you see computer science in your everyday life? How can the ways in which you experience computing differ from someone across the street, from a different culture, in another climate, etc.?

Tending to the Collective

Rather than framing systemic issues as individual responsibilities, such as Shanel's campaigns for ecological justice, we move towards “sharing the burden of survival” (Nuckolls, 2020, p. 1). To care for our Black students, we must care for the environments that cultivate and support them. In tending to the collective, we envision computing education as a relational feat. These would be centred in Black youth enjoying full experiences of learning, rather than being prepared to soon be workers (Nxumalo & ross, 2019). Since we are all affected by computing, we should learn about it in a way that prioritizes our ecology and relations, including humans, more-than-humans, the lands, and waters. This might be accomplished within experiences that bridge intergenerational community and land relationships in computing environments. One way we consider this is in ensuring that young people have the space

to dream within their learning environments. Further we should make space to consider what happens to technologies as they become inundated. Even recycled technologies, pollute the earth through soil and water contamination (Abdur-Rahman & Browne, 2021). We position care for the environment as important to the care of all of us, as we think of the ancestral technologies that we have access to through learning with land and water (Bang et al., 2013; Nxumalo & ross, 2019; Flowers, 2019).

We invite you to pause and reflect: How might you envision healing in and around the computing education community? How are you taking care of all of our relations?

Committing to Action

We are committed to learning and doing, in ways that we can make visible to others for our collective benefit. Many have *been doing* the work of abolition at various scales, such as Auntie Miri in our first story, who offered shelter (a form of mutual aid) to Shanel in a moment of desperation. Intent and supportive thoughts alone will not change the material, emotional, and relational conditions in this world. We ask all of us to commit to the work both within and beyond the classrooms and the universities we inhabit. This could include fighting algorithmic oppression by challenging Big Tech to interrupt their racist algorithms (Noble, 2018), or weaving socio-political context and questions of ethics throughout a syllabus. We must move even when the possible futures seem uncertain, because we want to ease the burden for future generations. This work is not done alone, and with more dreams and action, we can conjure life filled futures.

We invite you to pause and reflect: What are small steps that you can take to move forward, responsibly and alongside your communities? How will you leave room for grace if you make a mistake in the process, while still holding yourself accountable?

In this second story we utilize the questions in this section to form an idea of how we might revive and create more life for Shanel. The role of the university, the individual, and the community shift to enable a world that is more life giving. It is not perfect, as liberation is an ongoing process, but we work to show how another world is possible. We remind you of our second research question, “How might integrating an abolitionist framework into computer science open up possibilities for world-building and dreaming in the name of Black Life?” Take a moment to dream, what might you want to see for Shanel now?

Won't You Help to Sing These Songs of Freedom?

Shanel is a young Black college student from “the Swamp,” a neighborhood inhabitants describe as a place that beams diversity and life. Her community is healing from the past, breathing better each day. In the times before, environmental pollution, surveillance of their movements, and defunded education haunted the neighborhood. Now, as the inhabitants and the world work towards abolition, a new livingness is possible.

Shanel walked along her neighbourhood in high spirits. It was her first day of her herbal apprenticeship, and she had been finally approved to take Computing and Sustainability. Her sneakers were crisp and she carried a spare pair for working in the garden. Her shirt was untucked from rushing around, and her jacket was probably a size too big — but that was just for her personal style. She liked to be cozy and wanted mobility to get done what needs to be done. Shanel had been nervous about going far away for her apprenticeship but decided to take the risk after seeing what reciprocal relationships might do for the towns. Tuition is no longer a charge as the foundation of college has changed. The Swamp funded her housing and her food was covered by the host community centre through her work in the garden. Shanel had stitched her cousin's quote onto the back of her jacket as a reminder for herself of what it

took to get to where they are today. “When you stand up for something, some of us put our lives on the line.” A quote for ancestral remembrance, and diligence towards the work that continues to be done.

Slowly the engineering hub, formerly the engineering school, came into view. Widely known by the community as the Ubuntu centre, the hub is a thriving community centre that hosts an overnight shelter for local inhabitants. It has become a central resource for everyone in the community. For years now, they have been paying reparations to Black families as well as land tax to local Indigenous communities. Shanel remembered how in her first-year sustainability class, she helped others learn how to compost, a practice they had been doing in the Swamp forever. It felt so nourishing to share her practices with others. She had also worked with the community to establish partnerships with the Ubuntu centre to reduce the excess food from day students, and fund meals for the community. After checking in with her friends in the lobby, she headed to her community garden.

Shanel arrived, ready to learn from a community elder who had been tending to the garden for decades. Shanel often turned to that soil as a friend, pouring her spirit into it during her weekly practices. The course was co-facilitated by a previous student of the garden who had learned computing skills and had helped create the garden’s new irrigation system for both manual and automated options. Shanel, along with her classmates, was excited to learn alongside the community and co-create within their sustainable networks. In the Computing and Sustainability workshop, they were addressing how to build algorithms that build coalitions and create multidisciplinary intergenerational blueprints for the future (Milner, 2019). In her apprenticeship, students worked with Reishi mushrooms. They studied how Reishi’s deep networks, which often bury in dying trees, teach us about how we sustain and care for each other to the end. After thanking and preparing the Reishi mushrooms, Shanel paused as she heard chatter amongst the people in the garden and cacophony from the cicadas on the trees.

Shanel’s friend Wallace approached her to share about the possible expansion of the engineering hub in the latest community newsletter. In the newsletter, the hub leadership claimed that expansion was necessary to power additional sources for new computers. The expansion was supposed to support the community’s growing interest in learning and adapting technology sustainably. When Shanel opened the newsletter moments later, she exclaimed, “They want to build it right next to our garden, which will block sunlight!” The hub had been talking about their institutional power in relationship with the community, so it was hard for her to make sense of why they would choose this spot for a building. The workers in the garden all came to a standstill and collectively moved to sit on tarps to strategize with Shanel. They brainstormed what they might do, while she took notes on her phone. They asked for a report on the sustainability of the materials with which they planned to expand, and whether the funds might be better allocated towards serving the community. Further, they wanted leadership to reconsider how they might repurpose underutilized space.

They worked with a community artist to develop a flyer and draft emails to the expansion board. Shanel decided to reach out to the professor of the Computing and Sustainability class she was a part of, and asked if she could join the meeting with Ubuntu leadership. Initially confused, the professor realized after a few minutes that the committee must have never hit send on the follow up. They had intended for it to be a community conversation to discuss the plan. The professor said that she would have them forward it again and suggested to Shanel that she could bring anyone she knew. Shanel then forwarded a copy of the plan to the city’s local newspaper, and they worked on preparing informational zines to invite people to the meeting. She coordinated with friends to paste copies around the community and throughout social media. They promised community elders they would take care of the flyers and properly recycle them. While she was pasting some up, she looked at the defunct cameras on poles and wondered how they could organize to take them down and recycle them too. Through the flyering work, news of the need for sustainable computers reached alumni from the hub who had been working in a lab on battery-less technologies (Hester, 2017).

Alumni were in the planning phase of moving from small handheld devices towards full computers, but lacked the resources to do so. After the community members gathered and presented to Ubuntu leadership, the hub decided to reallocate the funds to help the alumni build batteryless computers. Their idea was not perfect but, with the support of others, they were able to get to a working product within two years. In the interim, the hub organized a mutual aid system with the community close by to share computers at a centralized location. By saving money on expansion, leadership was able to increase their reparations and land tax payments in Ubuntu's budget. In addition, someone at the meeting suggested that they repurpose classrooms as a community dialogue centre to transform harm; the centre would host training for people to learn new mediation strategies and de-escalation tactics.

With some excitement she headed to the garden where she encountered one of her favourite people, an elder in the community whom she referred to as Auntie Miri. Miri lived in the heart of the thriving neighbourhood, and it seemed as though the plants would really grow if she whispered to them. Willow trees wrinkled at the corner of her eyes, and she was beginning to gray. You could always find Auntie Miri either caring for neighbourhood children while their guardians worked during the day, or tending to the local garden. On this day, Shanel sat to work alongside her in the garden, and they began to chat:

Shanel: *[Rushed and excitedly]* Auntie Miri, have you heard?

Miri: *Mmm?*

Shanel: *It's everything and more, this*

Miri: *Slow down, what's happening?*

Shanel: *They're using the funds in ways I hadn't even thought about. I'm so happy to have been a part of this community.*

Miri: *Wow, not too long ago we were at the pickets demanding they decrease campus surveillance.*

Shanel: *Mhmm and they might bring me onto the team to develop the computers! They really liked what I was mentioning about Reishi mushroom mycelium as network infrastructures.*

Miri: *[Miri smiled and nodded]* Pass me the shovel won't you.

Miri *sang.*

Conclusion

In reflecting on the construction of Shanel's original narrative, we grappled with writing into existence the punishment and possible death of yet another Black person. We also wrestled with how this work might contribute to deficit narratives and monolithic Black experiences within CS systems. We emphasize that while the first story does not account for all Black student experiences in CS, there are areas to which many can relate. There are several other themes in Shanel's story that we were unable to address at length: the "unintended consequences" (Parvin & Pollock, 2020) of anticipatedly harmful technologies; the ties to conceptions of Black criminality (Muhammad, 2019) and white innocence (Leonardo, 2004); nuances of class (Eubanks, 2018); and the notion many minoritized students already have of "selling out" through participation in CS careers (Vakil, 2020).

Through Shanel's restorying, we attempted to write ourselves out of a world so focused on Black death, into a world that cultivated and sustained Black Life and Joy. With the work we did generating prompts as possible actions towards abolition, we sought to show a transformation harm in CS education. We wove this throughout the second story, where the university became a hub for the community to gather, inhabit, and share in its resources. Note the shift in dynamic between the hub and the community, from the way they share resources to the ways in which they communicate and contend with one another. This is "Black liberatory fantasy", in that it celebrates the joy and health of the community, which is in and of itself in disorder to the system which produces so much anti-Black terror (Dumas, 2018).

When we consider directions for the future of this work, we sit with the starting orientation of writing from Black death and dehumanization (McKittrick, 2020). McKittrick (2020) encourages undisciplined interdisciplinary projects that reveal paths towards a Black humanity, through relationality and away from race(ism). In beginning to sit with this work we wonder, what might shift if we were to restructure this paper to *begin* with Black Livingness? Is there a computer science education, an “algorithm” (McKittrick, 2020), that could hold Black Life with all its fullness? We arrived at abolition as a way of seeking Black Life. As we move forward, we plan to continue embodying abolition into the work and the environments we inhabit (Jones & melo, 2020). It is not up to us alone to do this work, but rather it is work for everyone in the fields of computing education. We look to the examples of Urban Environments and the Education Research Coven, who demonstrate abolition working in tandem with STEM (Das & Adams, 2019). This work inspires us to discuss the interconnectedness of research, practical work, and activism through public pedagogy (Abolition Science, 2018).

As a final point, we do not reveal all the Joy/Subversion throughout Shanel’s restory. This is an intentional practice of holding some things sacred, while also pushing readers to deeply engage with storied work. We encourage you to trace changes between stories, in conversation with friends and one another.

How can you help us build futures that love Black Life?

Please visit (<https://linktr.ee/CSAbolition>) for links to resources on themes from this paper.

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References

- Abdur-Rahman, A. & Browne, S. (2021). Capture, illegibility, necessity. *The Black Scholar*, 51(1), 67–72, DOI: <https://doi.org/10.1080/00064246.2020.1855293>
- Abolition Science. (2018). <https://www.abolitionscience.org/>
- Adams, C. (2021, May 12). *Republicans announce federal bills to “restrict the spread” of critical race theory*. NBC News. <https://www.nbcnews.com/news/nbcblk/republicans-announce-federal-bills-restrict-spread-critical-race-theory-n1267161>
- Akom, A. A., Scott, A., & Shah, A. (2013). Rethinking resistance theory through STEM education: How working class kids get world class careers. In *Youth resistance research and theories of change*, 153–165.
- Arute, F., Arya, K., Babbush, R., Bacon, D., Bardin, J. C., Barends, R., Biswas, R., Boixo, S., Brandao, F. G. S. L., Buell, D. A., Burkett, B., Chen, Y., Chen, Z., Chiaro, B., Collins, R., Courtney, W., Dunsworth, A., Farhi, E., Foxen, B., Martinis, J. M. (2019, October 23). Quantum supremacy using a programmable superconducting processor. *Nature*. https://www.nature.com/articles/s41586-019-1666-5?error=cookies_not_supported&code=508cb50f-3eaf-4152-829e-b714d4cbd84f
- Bang, M., Marin, A., Faber, L., & Suzukovich, E. S. (2013). Repatriating indigenous technologies in an urban Indian community. *Urban Education*, 48(5), 705–733. <https://doi.org/10.1177/0042085913490555>

- Bang, M., & Medin, D. (2010). Cultural processes in science education: Supporting the navigation of multiple epistemologies. *Science Education*, 94(6), 1008–1026.
- Bang, M., Warren, B., Rosebery, A. S., & Medin, D. (2012). Desettling expectations in science education. *Human Development*, 55(5–6), 302–318. <https://doi.org/10.1159/000345322>
- Barnard Center for Research on Women. (2014, January 7). *Reina Gossett + Dean Spade (part 1): Prison abolition + prefiguring the world you want to live in* [Video]. YouTube. <https://www.youtube.com/watch?v=XDQIW1uJ8uQ>
- Bell, D. (1991). Racial realism. *Connecticut Law Review*, 24, 363.
- Benjamin, R. (2016). Racial fictions, biological facts: Expanding the sociological imagination through speculative methods. *Catalyst: Feminism, Theory, Technoscience*, 2(2), 1–28.
- Benjamin, R. (2019). *Race after technology: Abolitionist tools for the new Jim Code*. Social forces.
- Browne, S. (2015). *Dark matters: On the surveillance of blackness*. Duke University Press.
- Buolamwini, J., & Gebru, T. (2018). Gender shades: Intersectional accuracy disparities in commercial gender classification. In *Conference on fairness, accountability and transparency* (pp. 77–91). PMLR.
- Christian, B. (1988). The race for theory. *Feminist Studies*, 14(1), 67–79. <https://doi.org/10.2307/3177999>
- Critical Resistance. (2020, October). *Our communities our solutions: An organizer's toolkit for developing campaigns to abolish policing*. http://criticalresistance.org/wp-content/uploads/2020/10/CR_Abolish-Policing-Toolkit_2020.pdf
- Critical Resistance. (2021). “What is the PIC? What is abolition?” <http://criticalresistance.org/about/not-so-common-language/>
- Code.org, CSTA, & ECEP Alliance. (2020). 2020 State of computer science education: Illuminating disparities.
- Das, A., & Adams, J. D. (2019). Critical transdisciplinary STEM: A critical numeracy approach to STEM praxis by urban environments and education research coven. In *Critical, transdisciplinary and embodied approaches in STEM education* (pp. 291–306). Springer, Cham.
- Du Bois, W. B. (1935). Does the Negro need separate schools? *Journal of Negro Education*, 328–335.
- Dumas, M. J., & ross, k. m. (2016). “Be real black for me” imagining BlackCrit in education. *Urban Education*, 51(4), 415–442.
- Dumas, M. J. (2018). Beginning and ending with Black suffering: A meditation on and against racial justice in education. In W. K. Yang & E. Tuck (Eds.), *Toward what justice?: Describing diverse dreams of justice in education* (1st ed., pp. 29–45). Routledge.
- Eglash, R. (2007). Broken metaphor: The master-slave analogy in technical literature. *Technology and Culture*, 48(2), 360–369.
- Esmonde, I., & Booker, A. N. (2017). *Power and privilege in the learning sciences: Critical and sociocultural theories of learning*. Routledge.
- Eubanks, V. (2018). Automating inequality: How high-tech tools profile, police, and punish the poor. St. Martin's Press.
- Flowers, A. R. (2019). Hoodoo book of flowers: The great black book of generations. (n.p.): *Rootwork Press*.
- Freire, P. (1970). *Pedagogy of the oppressed*. New York, NY: Continuum.
- Hester, J., & Sorber, J. (2017). The future of sensing is batteryless, intermittent, and awesome. In *Proceedings of the 15th ACM conference on embedded network sensor systems* (pp. 1–6).
- History.com Editors. (2019, October 10). *Cotton Gin and Eli Whitney*. HISTORY. <https://www.history.com/topics/inventions/cotton-gin-and-eli-whitney>
- Jones, S. T., & melo, n., (2020). “Anti-blackness is no glitch”: The need for critical conversations within computer science education. *XRDS* 27, 2 (Winter 2020), 42–46. <https://doi.org/10.1145/3433134>
- Kaur, V. (2020). *See no stranger: A memoir and manifesto of revolutionary love* (Illustrated ed.). One World.
- Ladson-Billings, G. (1995b). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465–491. <https://doi.org/10.3102/00028312032003465>
- Lee, C. D. (2001). Is October Brown Chinese? A cultural modeling activity system for underachieving students. *American Educational Research Journal*, 38(1), 97–141. <https://doi.org/10.3102/00028312038001097>
- Lee, C. H., & Soep, E. (2016). None but ourselves can free our minds: Critical computational literacy as a pedagogy of resistance. *Equity & Excellence in Education*, 49(4), 480–492.
- Leonardo, Z. (2004). The color of supremacy: Beyond the discourse of “white privilege.” *Educational Philosophy and Theory*, 36(2), 137–152. <https://doi.org/10.1111/j.1469-5812.2004.00057.x>
- Lindsay McKenzie. (2020, April 3). *Zoombombing isn't going away, and it could get worse*. Inside Higher Ed. <https://www.insidehighered.com/news/2020/04/03/zoombombing-isn%E2%80%99t-going-away-and-it-could-get-worse>
- Love, B. L. (2019). *We want to do more than survive: Abolitionist teaching and the pursuit of educational freedom*. Beacon Press.
- Marley, B. (1980). Redemption song. On uprising [Audio file]
- 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.
- McKittrick, K. (2020). *Dear science and other stories*. Duke University Press.
- Milner, Y. (2019, December 31). *Abolition means the creation of something new - Yeshi*. Medium. <https://medium.com/@YESHICAN/abolition-means-the-creation-of-something-new-72fc67c8f493>
- Mueller, C. (2004). Ella Baker and the origins of “participatory democracy”. *The black studies reader*, 1926–1986.
- Muhammad, K. G. (2019). *The condemnation of Blackness: Race, crime, and the making of modern urban America, with a new preface* (2nd ed.). Harvard University Press.

- National Science Foundation. (2017). *Data tables - nsf.gov - Women, minorities, and persons with disabilities in science and engineering - NCSES - US National Science Foundation (NSF)*. <https://www.nsf.gov/statistics/2017/nsf17310/data.cfm>
- Noble, S. U. (2018). *Algorithms of oppression: How search engines reinforce racism*. NYU Press.
- Nuckolls, D. L. (2020, April 10). *Social skills: Venus retrograde 2020*. The people's oracle. <https://thepeoplesoracle.com/venus-retrograde-2020/>
- Nxumalo, F., & ross, k. m. (2019). Envisioning black space in environmental education for young children. *Race Ethnicity and Education*, 22(4), 502–524.
- Paré, D. (in press/2021). Queering computing and computing education. In *Oxford research encyclopedia of education*. <http://hdl.handle.net/1880/113168>
- Parikh, T., & Sabie, S. (2021). On destruction in design. *SIGCAS Comput. Soc.*, 49(3), 14–15. <https://doi.org/10.1145/3447913.3447921>
- Parvin, N., & Pollock, A. (2020). Unintended by design: On the political uses of “unintended consequences.” *Engaging science, technology, and society*, 6, 320. <https://doi.org/10.17351/ests2020.497>
- Philip, T. M., Bang, M., & Jackson, K. (2018). Articulating the “how,” the “for what,” the “for whom,” and the “with whom” in concert: A call to broaden the benchmarks of our scholarship. *Cognition and Instruction*, 36(2), 83–88. <https://doi.org/10.1080/07370008.2018.1413530>
- Pinkard, N., Martin, C., McKinney, M., de Royston. (2017). Digital youth divas: Exploring narrative-driven curriculum to spark middle school girls’ interest in computational activities *Journal of the Learning Sciences* 26 <https://doi.org/10.1080/10508406.2017.1307199>
- Project Nia. (2020). Against punishment curriculum. <https://abolitionist.tools/Against-Punishment>
- Robinson, C. J. (1983). *Black Marxism: The making of the black radical tradition*. London: Zed.
- Rodriguez, S. L., & Lehman, K. (2017). Developing the next generation of diverse computer scientists: The need for enhanced, intersectional computing identity theory. *Computer Science Education*, 27(3–4), 229–247. <https://doi.org/10.1080/08993408.2018.1457899>
- Sandoval, C. D. M. (2017). Critical ancestral computing for the protection of mother earth. In *Culturally sustaining and revitalizing pedagogies* (Vol. 29, pp. 25–40). Emerald Publishing Limited. <https://doi.org/10.1108/S1479-368720150000029004>
- Scott, K. A., & White, M. A. (2013). COMPUGIRLS’ standpoint: Culturally responsive computing and its effect on girls of color. *Urban Education*, 48(5), 657–681.
- Scott, K. A., Sheridan, K. M., & Clark, K. (2015). Culturally responsive computing: A theory revisited. *Learning, Media and Technology*, 40, 412–436. <https://doi.org/10.1080/17439884.2014.924966>
- Sengupta-Irving, T., & Vossoughi, S. (2019). Not in their name: Re-interpreting discourses of STEM learning through the subjective experiences of minoritized girls. *Race Ethnicity and Education*, 22(4), 479–501.
- Shange, S. (2019). *Progressive dystopia: Abolition, antiblackness, and schooling in San Francisco*. Duke University Press.
- Sharpe, C. (2016). *In the wake*. Duke University Press.
- Simonite, T. (2020, December 10). *Behind the paper that led to a Google researcher's firing*. Wired. <https://www.wired.com/story/behind-paper-led-google-researchers-firing/>
- Smith, C. A. (2021) Impossible privacy, *The Black Scholar*, 51:1, 20–29, <https://doi.org/10.1080/00064246.2020.1855090>
- Solórzano, D. G., & Yosso, T. J. (2002). Critical race methodology: Counter-storytelling as an analytical framework for education research. *Qualitative Inquiry*, 8(1), 23–44. <https://doi.org/10.1177/1077800402008001003>
- Stovall, D. (2018). Are we ready for ‘school’ abolition?: Thoughts and practices of radical imaginary in education. *Taboo: The Journal of Culture and Education*, 17(1), 6.
- Toliver, S. R. (2020). Can i get a witness? Speculative fiction as testimony and counterstory. *Journal of Literacy Research*, 52(4), 507–529. <https://doi.org/10.1177/1086296X20966362>
- Tuck, E., & Yang, K. W. (Eds.). (2018). *Toward what justice?: Describing diverse dreams of justice in education*. Routledge.
- Vakil, S. (2014). A critical pedagogy approach for engaging urban youth in mobile app development in an after-school program. *Equity & Excellence in Education*, 47(1), 31–45.
- Vakil, S. (2020). “I’ve always been scared that someday I’m going to sell out”: Exploring the relationship between political identity and learning in computer science education. *Cognition and Instruction*, 38(2), 87–115. <https://doi.org/10.1080/07370008.2020.1730374>
- Vakil, S., & Ayers, R. (2019). The racial politics of STEM education in the USA: Interrogations and explorations.
- Vakil, S., & Higgs, J. (2019). It’s about power: A call to rethink ethics and equity in computing education. *Communications of the ACM*, 63, 31–33.
- Van Wart, S. J. (2019). *In search of a “fair explanation”: Helping young people to consider the possibilities, limitations, and risks of computer-and data-mediated systems* (Doctoral dissertation, UC Berkeley).
- Vossoughi, S., & Vakil, S. (2018). *Toward what ends? A critical analysis of militarism, equity, and STEM education*. 25.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard Univ Press.
- Ward, J. V. (2018). “Staying woke: Raising black girls to resist disconnection” in *The crisis of connection: Roots, consequences, and solutions*. Edited by Way, N., Ali, A., Gilligan, C., & Noguera, P., NYU Press.
- Washington, A. N. (2020). When twice as good isn’t enough: The case for cultural competence in computing. In *Proceedings of the 51st ACM technical symposium on computer science education* (pp. 213–219).

Wenner-Gren Foundation. *Black and indigenous storytelling as counter-history* [Video]. Vimeo. <https://vimeo.com/469900658>
Yosso, T. J. (2014). Whose culture has capital? A critical race theory discussion of community cultural wealth. In *Critical race theory in education* (pp. 181–204). Routledge.

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