Intercultural Computing Education: Towards Justice Across Difference

IAN ARAWJO, Cornell University
ARIAM MOGOS, Stanford University

Even in the turn towards justice-oriented pedagogy, computing education tends to overlook the quality of intergroup relationships, which risks entrenching division. In this paper, we establish an intercultural approach to computing education, informed by intercultural and peace education, prejudice reduction, and the sociology of racism and ethnicity. We outline three major concerns of intercultural computing: shifting from content towards relationships, from cultural responsiveness to cultural reflexivity, and from identity to identification. For the last, we complicate discourses of race and identity widespread in U.S. education. Drawing from studies of youth programming classes in East Africa and U.S. contexts, we then reflect on our attempts to address the first shift of fostering relationships across difference. We highlight three promising design tactics: intergroup pairing, interdependent programming, and making relational goals explicit. Overall, we find that computing can indeed be a site of intergroup bonding across difference, but that bonding can carry complications and tensions with other equity goals and tactics. Rather than framing justice-oriented CS primarily as changes to the aims of computational learning, we argue that future work should explore making relational goals explicit and teach students how to attend to friction.

CCS Concepts: • **Social and professional topics** → *Computing education*; • **Applied computing** → *Collaborative learning*.

Additional Key Words and Phrases: culture, intergroup contact, equity, race, intercultural education

1 INTRODUCTION

Over the past several years, computing and STEM education has seen a rise in work that engages questions of power and equity through the lens of critical theories [1, 72, 129, 135]. In response to the failures of technoutopianism, bias of algorithms, polarization of social media and globalizing white nationalisms, such scholarship has become front-and-center in conferences, grants, and calls for papers. Yet broaching political topics in diverse classes can often surface tensions and conflict. Where societies are fractured and fracturing, it becomes all the more important –and all the more challenging –to bridge divides and fight against "othering" [102]. The greatest challenges of our time –e.g., climate change, economic inequality, human displacement –will require coalitions and solidarity across difference to sustain enough momentum to make change.

What is the role of computing education in fostering relationships across difference and combating othering? How might computing and making education –which involve the kind of shared tasks

Authors' addresses: Ian Arawjo, Cornell University, Ithaca, New York, 14850, iaa32@cornell.edu; Ariam Mogos, Stanford University, d.school, Stanford, California, 94305, ariam@nairobiplay.org.

and non-competitive, low-stakes collaboration that are key for intergroup contact –be designed as sites for fostering belonging *for all* in contexts of entrenched inequities? Can we "make" peace while advancing justice and addressing inequity? Where do our theoretical frameworks work well for understanding these questions, and where do they fall short? And what are the honest limitations of these hopes, including tensions with other goals and learning outcomes?

In this paper, we establish an "intercultural" approach to computing education centered around these questions, called *intercultural computing education* (hereafter intercultural computing or IC). Over the past four years, we have explored programs, guidelines and activities aimed at fostering intercultural learning[1] in computing spaces, from deploying a program in Kenya for multi-ethnic refugee youth, to work in U.S. contexts. Drawing from literature in sociology, peace education, intercultural education and intergroup contact, we establish three main concerns or challenges for this space: shifting from *content towards relationships*, from *cultural responsiveness to cultural reflexivity*, and from *identity to identification*. In some cases, these shifts are in tension with prevailing tactics or discourse, such as minimizing friction, segregating students along categorical axes to improve equity outcomes, or framing race as an *a priori* identity.

After establishing these concerns, we explore the first shift –how to foster relationships across difference –in greater detail by drawing from studies of intro programming classes in Kenya and the U.S. In the Kenya program, the curriculum was deliberately designed to integrate conflict resolution and intercultural learning activities; while in the U.S., programming activities in an existing curriculum [46] were modified to facilitate bonding and exchange, but without larger pedagogical changes. We discuss the quality of intergroup bonding in computing, from contextual factors to complications of bonding over othering, unequal, and racialized dynamics. We also analyze three design tactics for intergroup contact: deliberate grouping, a new 'interdependent' activity type to combat inequities over pair programming, and making bonding goals explicit to students through icebreaker, intercultural, and conflict resolution activities.

Ultimately, we argue that the deliberate conflict resolution pedagogy of the Kenyan program seemed to contribute significantly to intergroup bonding, in that it problematized normalized othering in classes, taught students *how* to attend to friction, and framed computing classes as sites to *practice* intercultural competence skills during computing activities with unlike others. Computing spaces thus are not necessarily sites of intercultural learning by virtue of diversity, pairing across difference, or even justice-oriented activities, but rather *become* such sites when practicing conflict resolution and bonding across difference were made explicit learning goals of the course. We suggest, however, that intercultural learning efforts in U.S. contexts can also be in tension with equity strategies that seek to minimize contact or radically defer to student agency. Instead of blanket solutions, future scholars should consider when and where to adopt an intercultural approach by considering context, class composition, and teacher ability.

2 DEFINING INTERCULTURAL AND THE PRINCIPLE OF FRICTION

We briefly define what we mean by 'intercultural,' since this term and meaning is referenced throughout the piece. Intercultural involves three aspects: *inter-*, *-cultural*, and *intercultural* taken together. *Inter-* emphasizes the relational and juxtaposed, which aims to highlight the fostering of relationships across difference –particularly politicized difference –in contrast to pedagogical and ontological frameworks of individualism, separation and control [43, 110]. *Cultural* specifies the terrain through which interaction occurs as people's behaviors, beliefs, practices, and heritage,

---

[1]Following Bennett [18], we use 'intercultural learning' as a banner to discuss an array of positive learning outcomes that might arise from interaction with diverse groups of people: awareness, respect, and understanding of differences; ability to work with different types of people; exchange of cultural or personal experiences; and the making of friends across traditional social group lines. 'Intergroup bonding' is a subset of these learning goals.

which are not fixed into boundaries of race or ethnicity [27, 61]. Although we may sometimes fall back into a singular 'culture,' we prefer '-cultural' following Appadurai, which "moves one into a realm of differences, contrasts, and comparisons that is more helpful" [5, p. 12].

When the two parts are combined, the term 'intercultural' is foremost a sensibility of how one's ways of being and knowing the world could be otherwise. This usage of 'intercultural' derives from the work of Edward Hall, who emphasized understanding culture as tacit communication and interpretation, rather than explicit features. Said Hall, "Culture hides much more than it reveals, and strangely enough what it hides, it hides most effectively from its own participants... The ultimate reason for [studying other societies] is to learn more about how one's own system works" [62, p. 53]. Through friction between cultural perspectives, intercultural education opens up alternative standpoints from which to criticize structural power, imagine transformative change, and to reflect on our own cultural 'programming.' For instance, many influential Black Americans, such as James Baldwin and Malcolm X, had their views on race altered by experiences abroad [45, 81, 142].

Consistent with this 'intercultural' frame, our guiding principle and pedagogical approach is uncovering and attending to emergent *friction* in educational spaces [7]. We view friction (i.e., between cultural perspectives, between students, or between students and teachers) *as a resource* for learning and change, rather than something to always minimize or avoid. Our goal is to consider how social frictions may be *uncovered* through deliberate design choices and *attended to* in productive or positive ways. Attending to friction follows the cultural-historical activity theory (CHAT) of Lev Vygotsky and others [26, 60], considering student learning as the resolution of 'contradictions' emerging from social and cultural activity. This aligns with Ashcraft et al.'s concept of "fragile interruptions," or frictions between teachers and students which teachers should be taught to "reframe [and] recognize... as resources for fostering, rather than thwarting" learning [9, p. 249].

Finally, we use the term "intergroup" to mean interactions between individuals considered by adults to be members of different social "groups" in a context, whether that identification is chosen or imposed [13]. Group identifications can be intersecting; however, we do not take the position that they are always self-chosen. One major reason we prefer intercultural to "intergroup" is because the latter's deployment can sometimes *perform* the grouping —i.e., participants may not consider the social difference as relevant, especially children [13, 64]. We will expand on this point shortly.

3 WHAT IS INTERCULTURAL COMPUTING? THREE CHIEF CONCERNS

Here we establish three chief concerns of intercultural computing: shifting from a focus on individuals or content towards relationships across difference, from cultural responsiveness to reflexivity on tacit aspects of culture, and from identities to (ascribed or rule-based) identifications. Elsewhere we have revealed a gap in computing education work that seeks to foster relationships across difference [7]. The key difference between our framing and others is our emphasis on computing education *as a vehicle for* intercultural learning, rather than social and cultural factors as a vehicle for computational learning. This reversal of emphasis is different from the vast majority of work; for instance, Kafai et al. [72] map three theoretical framings —cognitive, situated, critical —but all framings act as instruments for improving computational thinking. We believe that in some contexts, fostering solidarity across difference and advancing critical consciousness may be as important, or even more important goals than participants ultimately entering computing.

3.1 From content towards relationships

Over the past decades, researchers have sought to address issues of belonging for people under-represented in computing and STEM [120]. To address belonging, scholars have developed tactics like culturally responsive pedagogy, supporting student identity, and bringing social justice issues into the forefront of classes [24, 36, 72, 91, 100, 112, 120]. For example, Nasir & Vakil studied

racialized learning pathways at tech-centric high schools and co-designed a computing course that dealt with justice issues [91]; and Ryoo explored how teachers of color connect computing concepts to students' everyday lives, knowledge, and practices [112].

While one aspect of belonging involves appealing to students' sociocultural backgrounds, another aspect is relational [19]. Even where problems of access or participation are addressed, negative social dynamics in classrooms (e.g., micro-aggressions, social exclusion) can produce a negative atmosphere and continued marginalized students' attrition from computing [76, 83, 91, 139]. This points our attention to the 'upstream' factors of rac*ism* (and other discriminatory structures), rather than its downstream effects –to pay attention to social relations and norms that (re)produce divides and power structures in educational spaces. A key component of belonging is thus to pay attention to the quality of relationships that form, or don't form, in diverse classrooms.

Much work in the space, however, takes an individualist view rather than fostering relationships across difference [7, 133]. Some scholars have attributed omissions to reporting the quality of intergroup relationships to discomfort or incentives for such omission [114, 131]. For example, equity research (and grants) often revolve around measuring quantitative shifts in students' concept knowledge, identity, and attitudes towards computing, eliding attention to social relations [9]. To combat this tendency, Vossoughi et al. suggested that scholars should "consider the making of social relations as interwoven with the making of artifacts," a pedagogical practice which "must be carefully developed and documented rather than taken for granted as an innate feature of making environments" [135, p. 221]. Even in some studies under the banner of culturally-responsive computing (CRC), this tendency to focus on individuals can emerge.[2] One possibility is that, while CRC does not preclude authors from paying attention to relations across differences [16, 37, 75], its focus tends to be on supporting marginalized students' identities and ensuring (or developing) infrastructure to enable this support. For instance, tenets of the CRC framework of Scott et al. emphasize "learning about one's self" and "demonstrate understanding of their intersectional identities"; and even the principle of "connection" is spoken of as teachers' connections to students, rather than between students themselves [118, p. 415]. Where relations across difference are documented, scholars often refer to them as outcomes they did not necessarily expect beforehand (e.g., when a Jamaican-American student's bead loom design inspired a Diné/Navajo student [16], or a white Latina girl's cornrows design inspired a head cosmetologist [75]). In a piece on CRC, Eglash et al. remarked with surprise that "there is not a strong correlation between the heritage identity of the student and the cultural origin of the tool [they use]" and asked: "Is this broader attraction because their racial/cultural identity is more 'hybrid' than we expect?" [37, p. 34].

Ironically, the phrasing of this question reveals a slippage into "implicit models for identity" that Eglash et al. cautioned against in 2006 [36, p. 348]. Without downplaying how 'hybrid' can imply a prior of purity –a risk that, when in reference to race, can conspire with the state's processes of racialization [29, 89, 103, 122] –anti-racist scholars such as Gilroy, Erasmus, and Goldberg have long argued for tactics that emphasize radical interdependence and trouble notions of purity [42, 50, 53]. To this end, Gilroy introduced *conviviality* (living together) as "a measure of distance from the pivotal term 'identity,' which has proved to be such an ambiguous resource in the analysis of race, ethnicity, and politics. The radical openness that brings conviviality alive makes a nonsense of closed, fixed, and reified identity and turns attention toward the always unpredictable mechanisms of identification" [50, p. xv]. Developed for multicultural settings, this anti-racist orientation is not in denial about power, but rather wishes to strive towards a future normalization of difference where

---

[2]For instance, Davis et al. studied a youth CS class organized around speculative fiction and a variety of cultural traditions [30]. The population was moderately diverse from the standpoint of racial and ethnic categories, yet reported outcomes focused almost exclusively on cognitive and attitudinal changes. No mention is given to the intergroup relationships that were, or were not, forming in the classroom or why.

"racial differences become ordinary, banal, unremarkable and sometimes mundane to the point of boredom" [10, p. 522].[3] While sociocultural factors are important to both CRC and intercultural computing, the key difference is that in CRC, identity is foregrounded; in intercultural computing, relationships across difference (and hence shared affinities) are foregrounded –to be designed for, attended to from the outset, and even measured as an outcome of the program itself. Neither framing is necessarily 'better,' but rather they prioritize different goals, contexts, and analyses.

Certainly, educators have long been aware of social tensions in computing [83, 120, 131]. With a few exceptions in international contexts [145, 146], however, tactics to address tensions often aim to minimize friction and avoid it, whether indirectly or by design. For instance, pair programming studies that report conceptual and attitudinal outcomes often operate under the assumption of letting students pick pairings (e.g., [78]) which can reinforce existing intragroup relations. Understandably, so too have some educators leaned into a strategy of segregation which separates students along specific axes of difference at the program-level in order to combat issues of belonging [9, 100]. Strategies of segregation, as Du Bois emphasized, can build a sense of community and resilience in the face of othering [95], but a hyper-focus on only marginalized students risks neglecting learning that needs to happen for over-represented students who then perpetuate the same exclusionary dynamics we seek to combat [9, 57, 127].[4] Such strategies can also neglect other populations. As one Latina girl asked, "Why are there no boys here, if [the program] is [for] people of color?" [9, p. 244] –raising important questions being addressed by new programs like Black Boys Code [25].

A variety of literatures have addressed how to foster social bonds across difference and counteract tension, including prejudice reduction [94], peace education [116], intercultural education [18, 56], and intergroup dialogue [59]. Like anti-racist pedagogy and critical shifts in computing education [54, 135], many approaches involve reflection on positionalities and acknowledge that denial and defense stages are natural stages towards change [17, 59]. Unlike recent justice-oriented or critical computing approaches, however, many peace-building approaches suggest first reducing attention to differences through collaboration on a shared task [116], humanizing the other before engaging participants in more contentious topics. Intergroup dialogue suggests an alternative tactic of separating participants initially to prepare them for empathetic listening during later, integrated dialogues [34, 59]. Despite their differences, the consensus from these literatures is that simply putting diverse students together and beginning to talk about charged political topics –without any preparation or scaffolding –is likely to result in division and strife [34, 98, 116].

Finally, designs to foster relationships must acknowledge the constraints of different contexts and class compositions. Allport's contact hypothesis specifies four ideal conditions for positive interactions: equal status of groups in the local context, work on a shared task, cooperation without competition, and shared acknowledgement of an authority figure which facilitates the contact [98]. Classes where one or two students will be tokenized, as Margolis et al. detail [83], cannot realize the equal status constraint and are not the main target of intercultural efforts. Still other contexts' divides might be so strong –e.g., active conflict situations –that parents may resist the authority of the implementers when their child transgresses social boundaries [14]. And finally, teachers must be trained to attend to emergent conflicts that arise between students across (and

---

[3]Conviviality's focus on affinity also means that it finds absolutist notions of cultural appropriation counter-productive [50, p. 132-3], e.g. the pushback towards a Black girl who went TikTok viral Irish dancing to hip-hop music [35].
[4]Chen, a female undergrad in computing, outlines the process perfectly: "A girl grows up seeing only boys fiddling with science kits and labs on TV. She gets involved in a Girls Who Code program and, through the support of undergraduate role models, decides to major in computer science in university. But there, microaggressions in the academic setting... and imposter syndrome are quick to bat down her confidence. She perseveres, participating in the Grace Hopper Conference... [and] landing an internship... After settling in, others tell her that her offer was only the product of a quota" [22].

about) differences, and their positionality may affect their ability to resolve friction if it means that participants contest their authority [9, 15].

3.2 From cultural responsiveness to cultural reflexivity

A common complication of intergroup dialogue programs is the emergence of non-verbal cultural differences which reproduce power dynamics in group discussions [59]. Students' intercultural development, which acknowledges that others have different ways of doing, being and knowing, is therefore critical to counteract these dynamics [17]. Cultural learning in computing is not new –scholars have long argued for connecting to students' cultural experiences, interests, and practices (e.g., cornrow braiding, textile weaving, skateboarding [36, 73, 112]). Yet this responsive framing of culture tends to focus on explicit, visible aspects like craftwork and language, consistent with earlier definitions of culture [119].

From an intercultural standpoint, culture also includes tacit, taken-for-granted knowledge which it "hides most effectively from its own participants" [62]. Patterson defines the procedural aspects of culture broadly as *cultural algorithms*: "stored knowledge of a 'predetermined, stereotyped sequence of actions that defines a well-known situation'" which are "prone to misconceptions and can usually be learned only by doing" [97]. Our introduction of the term "cultural algorithms," broadening Bennett's concept of "heritage algorithms" in craftwork [16], aims to emphasize the more pernicious and tacit rules that are often shared across people in a society. This second goal of 'intercultural' learning aims to teach self-awareness of one's cultural worldview. A cultural worldview "does not prescribe or determine the behavior of individuals who share the culture; rather, it constitutes the context in which perception and behavior occur" [18, p. 3]. Since contesting a cultural worldview may trigger denial and defensiveness [17], this is a harder learning goal to achieve: teachers and researchers themselves may view as "normal" or "natural" the very beliefs and behaviors intercultural education wishes to destabilize. This aspect of intercultural development intersects with calls for greater attention to bias and ethics in computing [1, 58, 129, 135, 139].

A great example of a cultural worldview is race in the U.S., as described in the work *Racecraft* by sociologists Barbara and Karen Fields [45]. The term 'racecraft' is chosen to parallel Evans-Pritchard's anthropological study of Azande witchcraft, where witchcraft was rational and naturalized as a belief for the Azande people. The Fields' argument is that "race" is also rational but a cultural way of seeing the world that switches cause and effect. Race "transforms the act of a subject into an attribute of the object" [44], a disappearing act where the context of racism naturalizes the concept of race. Racecraft's un-naturalness is revealed when foreigners come to the U.S. and describe how they learn to "see" race –i.e., adapt to a new cultural worldview [11]. Importantly, destabilizing tacit worldviews differs from learning about knowledge or practices [87, 136], as even well-trained New York Times data journalists can fall prey to racecraft.[5]

At first glance, teaching about cultural worldviews seems very far from learning computing. Upon closer inspection, however, intercultural and computational thinking may have deeper conceptual overlaps. According to Bennett, "intercultural learning includes *how to learn* about culture" (emph. original) and this separates it from other cultural education [18]. In other words, learners must 'think about their (cultural) thinking,' paralleling Seymour Papert's phrase. Computing concepts have been applied to examine sociocultural phenomena in domains of inquiry such as mechanism design for social good, law as code, and ethnopragmatics [2, 12, 52]. In a paper on the roles of computing in social change, for instance, Abebe at al. proposed a method of "algorithm as formalizer" [1] where social and cultural rules are externalized and then analyzed through computational concepts (e.g.,

---

[5]"How a Genetic Trait in Black People Can Give the Police Cover" by LaForgia & Valentino-DeVries, May 2021. https://www.nytimes.com/2021/05/15/us/african-americans-sickle-cell-police.html

inheritance law [12]). Rather than work in classical AI which advocated a philosophy that human behavior followed deterministic logic, this method does not claim that humans act as automatons, but rather that the *practice* of formalization can reveal more about the workings of social power and serve as a site for reflection on such rules. This perspective asks: Rather than (only) seeing algorithms as products of culture, where might we see culture as products of algorithms –distributed and tacit scripts and rules that inform beliefs and behavior? This question shares affinity with CRC [37, 75, 118], but like critical ancestral computing [87], also asks how can we surface "the code beneath the code" for students embedded in a particular cultural worldview [128, 136].

We will make this concrete with a brief example. When students "write code," they are performing translations between cultural representations and real-world behavior [6]. Writing a program about going to school, for instance, involves formalizing real-world behaviors like driving on roads and cultural institutions like schools. When encoded, these programs express and embed a cultural context. Viewed from someone inside that context, the program only appears like a story of the child's journey to school; but to someone far outside it, the program presents puzzles like the big car's yellow form, how people know where to drive on the roads, what the building means and why the child goes to it without their family.

One means to de-naturalize a tacit cultural belief –one's cultural "programming" –is through friction with other cultural or historical perspectives. This aspect of intercultural learning is described colloquially as "cultural shock," where people, moving to a vastly different society, shift from being "unaware of the subtle, culturally-defined rules and regulations that govern social encounters" towards understanding and adaptation to difference [137]. They also may "learn more about how one's own system works" [62] when returning home. Put more practically, we suggest that future work might extend the culturally-responsive method of "cultural algorithms" by externalizing and juxtaposing multiple, different cultural scripts and rules about a similar topic; the resulting friction may destabilize the learner's dominant ways of being and knowing and spark intercultural development [136, p. 529-30]. Rather than seeing cultural practices as bounded, however, scholars should encourage creative friction between practices that acknowledges how computing is –and has always been –a site of intercultural conflict [6].

3.3 From identity to identification

Vakil & Higgs stress for computing educators to pay attention to, and name, power dynamics and systems [134]. As we argued, strategies of segregation seek to improve participation, learning outcomes and attitudes of individuals under-represented in computing. But as categories are constructive, so too are they binding [81]. When categories are imposed from dominant power structures and groups –such as the ascription of "refugee" or racial designations in the U.S. –they are not benign. The categories remain implicated in oppression and outside of choice; they essentialize by default and beyond the total control of those whom they describe. Says Fields, criticizing the tendency of academics to slip into aligning "race" with notions of identity:

> *"Racism... unsettles fundamental instincts of American academic professionals who consider themselves liberal, leftist, or progressive. It is an act of peremptory, hostile, and supremely –often fatally –consequential identification that unceremoniously overrides its objects' sense of themselves. Racism thus unseats both identity and agency, if identity means sense of self, and agency anything beyond conscious, goal-directed activity, however trivial or ineffectual. The targets of racism do not 'make' racism, nor are they free to 'negotiate' it, though they may challenge it or its perpetrators and try to navigate the obstacles it places in their way. Even as racism exposes the hollowness of agency and identity, it violates the two-sides-to-every-story expectation of symmetry that Americans*

*are peculiarly attached to. There is no voluntary and affirmative side to racism as far as
its victims are concerned, and it has no respect for symmetry at all."* [44, p. 48]

Wrapped up in discourse which emphasizes "identity" and "agency," computing education, and
education more broadly, risks overlooking the difference between identification and identity that
is critical when examining categories ascribed to bodies and ancestries [20, 45]. In making this
switch, the Fields reference the seminal sociology paper "Beyond 'Identity,'" where the authors
critique the widespread concept of identity. Their first suggestion for un-bundling 'identity' is to
sometimes prefer language of 'identification':

*"As a processual, active term, derived from a verb, 'identification' lacks the reifying
connotations of 'identity.' It invites us to specify the agents that do the identifying. And
it does not presuppose that such identifying (even by powerful agents, such as the state)
will necessarily result in the internal sameness, the distinctiveness, the bounded groupness
that political entrepreneurs may seek to achieve. Identification −of oneself and of others
−is intrinsic to social life; 'identity' in the strong sense is not."* [20, p. 41]

This point about identification is not just a sociological abstraction for K-12 work that seeks to
counter social divides. Critical peace education is also concerned about adults' imposition of identity
categories and boundary-making, even going so far as to claim "identity wins" over peace-building
when it is overly emphasized. Zvi Bekerman, who spent over a decade studying intergroup contact
in integrated Israeli-Palestinian schools, summarizes the problem as the tendency of adults to
project their frameworks of difference onto children:

*"The attitudes of adults and children seem to reflect very different approaches to and
understandings of the construct of identity and its relevance within the social context.
Adults are concerned with the children's awareness of their identities; as such, adults seem
captive to hegemonic perspectives of an essentialized identity that reflects deep-rooted
issues that create (in part) the protracted nature of the very conflict they are trying to
resolve. Young children, however, not yet fully socialized into the historical realities that
gave birth to the conflict, seem not to hold to an understanding of identity as a boundary
marker, especially not one that entirely delimits their spheres of social contact."* [14, p. 77]

Indeed, Scott et al.'s tenet of "demonstrate understanding of their intersectional identities" exhibits
this exact concern [118]. We remind readers that adults in computing and STEM classes are not just
concerned with children's pre-given identities, they can (re)produce those identities. For 'race,' this
hidden work is particularly important to surface. In a justice-oriented CS class, Vakil observed a
girl who identifies as mixed race. During an argument with a white student over diversity, another
student who identifies as Black encouraged her to identify similarly [130]. When this event is
framed as only political, it misses the cultural learning: the other student is passing down the
cultural "one-drop" rule in the U.S.; were they in Latin America, the division emerging along "racial"
lines may be different. Said a dark-skinned girl who grew up in Japan: "I saw color [in Japan],
but I didn't see race. And I learned it going to America" [71]. An incident in the COMPUGIRLS
program illustrates similar discrepancies between identification and identity that often go hidden
or unnoticed by adults [9]. The teacher kept using the term "people of color," but for many girls,
the term didn't seem relevant. The teacher was "taken off guard by the girls' unfamiliarity with the
term... having grown accustomed to this term herself in graduate school" [9, p. 245]. This reveals a
hidden class divide in social justice discourse, whereby academics project their terms of difference
(such as "Latinx" [93]) onto participants −what al-Gharbi calls the culture of "symbolic analysts" [3]
−and often rationalize the projection despite noting its deficiencies (e.g., [77, p. 68]). Later, other girls
expressed annoyance that every project has to be about social justice (a problem avoided in Digital
Youth Divas [100]). As one student aptly put it, the underlying message was "y'all is at a deficit, suck

it in" [9, p. 246] –echoing Patterson's concerns about what he calls the "overracialization of Afro-American life" [96, p. 4]. As Bekerman continues: "If youth are educated within a master narrative that maintains a state of intractable group identities and negative interdependence by which the assertion of one group's identity requires negating the identity of the other... the possibility for a truly transcendent, peace-promoting, educational experience seems unlikely" [14, p. 79].

Currently, more dominant approaches in U.S.-based anti-racism, based in foundational texts in critical race theory (CRT) like those of Crenshaw or Delgado & Stefancic [28, 31], advance concepts of racial identity to achieve political change and uncover the valence of intersecting oppressions. Although these approaches emphasize reflexivity, they also tend to avoid deconstructionism as a matter of political strategy [28, 65]. These approaches are growing in dominance in U.S. education. While scholars agree on the importance of supporting students, not every scholar in anti-racism finds identitarian discourse un-problematic [42, 49, 68, 101]. Such scholars have, often for decades, complicated the notions of identity central to intersectionality by calling for shifts to identification [20, 29, 45, 49, 89, 103]. They argue that race-as-identity talk can often hide processes of racialization and obscure the goals of anti-racism [103, p. 212]. For instance, Gilroy argues that anti-racism risks becoming "a means for the rescuing of race from racism" [51] and for Erasmus, "the point of critical antiracist praxis is to eradicate both the effects of race and the ideas that underpin them... to destabilize all racialized thought and group identities, and to create possibilities for new belongings" [41, p. 397]. Nash documents how critiques of identity in intersectionality often engender "defensiveness" among some scholars, who counter that one is mischaracterizing the theory, not doing it right, or construe it as the property of Black women [89, 90].[6] Other critics have argued that undue emphasis on personal narrative and identity can impede solidarity, cross-cultural comparisons, and humanistic perspectives [29, 49, 68, 74, 81, 96, 99]. For instance, Tien found that an experience-based justice pedagogy caused students to naturalize identifications as essential identities; white-identified students, defined as 'oppressors,' then retreated from justice [125].

To be clear, we wholeheartedly agree with the importance of supporting students' varied identities and being color-conscious, and too few CS teachers and programs are culturally-responsive. Our issue is rather with the framing of *race* as identity and the conflations of race and culture that often follow. Such a framing and conflation can obscure racism and racialization [45, 49] and perform *ontological harm*, or "the forceful introduction of one worldview to the extent that it marginalizes or suppresses another worldview" [136, p. 546]. Like Patterson or the Fields, we would refer to Black/African-American as an ethnic or cultural identity [45, 96] and seek to be reflexive around processes of turning identifications into identities. We believe that this perspective may be especially important for efforts to break up whiteness rather than leaning towards problematic 'positive white identity' discourse [29, 41, 138]. While identity politics remains an important strategy against racial injustice, critical peace education and racecraft advocates a different approach for education (rather than political strategy): to teach participants, teachers, and researchers to historicize and deconstruct social categories [8, 13]. In doing so, students are not meant to vacate identities, but rather gain critical insight into their "making" and remaking —to become "critical design experts" of the social world —from which they can *re-emerge* as political actors [15]. This aligns with Toni Morrison's practice of deconstructing the 'racial house' through reflexivity in her writing practice, as well as Hoyt's call to not presuppose racial identity among children [68, 88].

---

[6]While she argues this defensiveness can be misplaced, she also suggests, like Rankin & Thomas, that it emerges from academia's embrace of intersectionality discourse while, ironically, continuing to overlook Black women [90, 105].

4   CONTEXT, PEDAGOGICAL MODEL AND METHODOLOGY

At the forefront of justice-oriented CS education, recent studies found such classes could entrench racial or socioeconomic divides and called on future work to pay a deeper attention to intergroup student relationships [131, 133]. Having established our chief concerns and challenges, we now explore the first shift –from content towards relationships –in greater detail in response to this call to action. We begin by describing our study contexts, pedagogical decisions, and methodology.

4.1   Study Contexts

This paper draws from multi-national action research and ethnographic studies of adolescent intro CS programs implemented in Kenya (Nairobi and Kakuma Refugee Camps 1-3) during 2018 and a 6th grade U.S. classroom in early 2020. Classes across contexts involved an intro programming curriculum with Scratch [107]. Since the Kenyan study operated in a lesser-known context in computing education –refugee communities in Kenya –we provide a brief overview for the reader. East Africa is composed of a diversity of ethnic groups across national and tribal lines, many often in tension or conflict with one another. In South Sudan and the Democratic Republic of Congo, resurgent violent tribal conflicts have destabilized regions and continued an influx of migration to Kenya. The Kenyan government permits refugees to live in one of two major camps, Kakuma and Dadaab, although many refugees unofficially live in Nairobi; discrimination towards the refugee population is widespread. Refugees in Kenya often live and attend school alongside those from other ethnic backgrounds, yet the rote-style education does not focus on cultural difference, conflict resolution, creative thinking, or cooperative work [86].

The Nairobi Play Project (NPP) is a 5-week intro computational thinking and game development program deployed in Nairobi and Kakuma refugee camp, Kenya serving multi-ethnic refugee and Kenyan youth ages 14-18. Participants came from a variety of national and tribal backgrounds, including Ethiopia, Democratic Republic of Congo, Burundi, Kenya, Tanzania, North and South Sudan, and Somalia. After-school classes of approximately 24 youth are facilitated by 1-2 teachers, local to the community. The curriculum and program model was designed and iterated over three program cycles over 2018, and two week-long pilots in January 2017 and August 2016; each full cycle involved five separate class sites, two in Nairobi and three in Kakuma refugee camp. The curriculum introduces computer programming and CS concepts through unplugged activities ("warm-up activities") and Scratch [107] in a similar progression to intro CS courses for middle school youth in the U.S. Programming concepts include procedures, loops, conditionals, and variables. Intercultural learning goals are integrated into the curriculum, pedagogy, and set-up, resulting in a hybrid course. Activities are also localized; for instance, one activity involves peeling a banana, another asks students to re-imagine the ancient East African game Bao la kiswahili (Mancala). By the choice of teachers, classes were taught primarily in English to mitigate communication differences across groups in Kenya; although Swahili also played an active role.

The second study was conducted at a northeast U.S. public school in two 6th grade classes for five weeks in early 2020. As a strategy to address racial and gender disparities in elective computer courses [83], the district made the classes mandatory for all students in the school. The site was chosen by the first author after visits suggested an undercurrent of racial dynamics. On average, approx. one-third of students in classes were students of color (see note in 4.3 for further clarification on categories). This composition reflected the majority-white student composition reported by the wider school district. The particular school is situated in a urban-rural intersection and integrates students from diverse socioeconomic backgrounds, including rural white students. Both classes were taught by the same teacher, an older white male (hereafter named Mr. M.) with a year's experience teaching the MyCS curriculum [46]. Mr. M. had taken a summer CS professional

development program and worked in schools with majority students of color; he aimed in classes to be culturally responsive, putting up posters of people of color scientists on walls and sometimes foregrounding Black music and art; and he seemed well-liked by some students of color who would stop by to say hello. Early in the observed class, for instance, students of color created Scratch projects around Kobe Bryant and Juice WLRD's untimely deaths, with the teacher playing a clean version of Juice WLRD's "Bandit" to center the latter project. The institutional context also aspired to be culturally-responsive and embrace social justice. Note that the U.S. study was disrupted by the onset of the 2020 COVID-19 pandemic right before students started final projects.

4.2 Pedagogical Models and Scaffolding

There are several approaches to intergroup contact, often with differing strategies on how direct interactions should be. The Nairobi Play Project's approach to scaffolding intergroup contact borrowed from peace education models common to the international development community [116]. Rather than intergroup dialogue [59], which focuses on direct conversations without an intervening task, a peace-building pedagogy aims to first distract from tension through shared tasks that build rapport across social boundaries and low-stakes interactions; a common task is playing sports [121]. This scaffolded approach aims to induce trust and bonding between students *before* sociopolically-charged topics are broached during discussions over justice-oriented game projects. The program model has been adopted by the United Nations Alliance of Civilizations (UNOAC) in Tunisia, Spain, and Morocco.

Following this approach, the NPP program model began each 90-minute class with rapport-building icebreaker activities, leading into pair programming activities on the computer. Many activities intersected with computational and HCI concepts; however, they also involved intercultural competence or conflict resolution, and a few did not involve any computing concepts whatsoever. For instance, the "Empathy Notes" activity asked students to write a sequence another student would perform, leading into a discussion on empathy –merging intercultural and computational learning goals –while a later activity was solely about how to resolve conflicts that emerge in conversations. The latter activities were grounded in Bennett's model of intercultural development, which specifies six stages moving from ethnocentrism (denial, defense or reversal, and minimization of difference) to ethnorelativism (acceptance of difference, adaptation, and integration) [17].

About halfway through the program and after students are comfortable with foundational programming and design concepts, students work in cross-cultural and cross-gender groups of three (ideally where each student is from a different national background) to develop a serious game embodying a shared, justice-oriented narrative; created games involved the health risks of open defecation, planting trees to save the environment, and exposing government corruption.

By contrast, the U.S. class followed a standard intro programming curriculum with Scratch, MyCS [46]. Critical to interpreting our findings, the U.S. class had thirty minutes less time than Kenyan classes, and the instructor did not wish to include the warm-up activities prevalent in the Kenyan program. The early warm-up activities of NPP were designed as relational icebreakers that taught computing and intercultural concepts while giving students a chance to play, have fun and interact across group lines. Without these activities and framing, interactions were mainly with who one sat near and who one was grouped with (as in a typical intro CS class that uses pair programming). To help cultivate interaction and exchange during partnered programming, MyCS activities were modified in relatively minor ways (e.g., drawing one's partner for learning to draw in Scratch), but *without* the framing of bonding across difference made explicit by the NPP program and teachers. We juxtapose these contexts to draw further insights on pedagogical choices and contextual factors that contribute or detract from intergroup bonding in computing.

4.3   Positionality, Data Sources and Methodology

The first author and primary fieldworker in both studies is an American male perceived as white in the U.S. and "mzungu" in Kenya, and students may react to his presence in classrooms in significant ways that impact study observations. In Kenya, differences in language and power dynamics could affect understanding and interaction; he often followed up with students and teachers to double-check emerging themes. The second author is an Eritrean-American woman who has extensive experience designing and delivering creative computing programs around the world, including in Spain, Sierra Leone and the U.S. She is also the founder and main designer of NPP and its pedagogical model, building on her international experiences in peace-building organizations.

The Kenyan study spanned two program cycles and involved observing participants across 5 class sites. Data was collected from fieldnotes, on-site images and videos, student Scratch programs, semi-structured interviews with teachers and students, teacher self-reporting on a shared WhatsApp group, and pre- and post- surveys with students. The first author conducted 8 teacher interviews (approx. 90 min) and asked written consent for audio-recording; for 24 student interviews (13F/13M; 13-19 years old; approx. 20 min), he sought oral assent and hand-wrote responses due to sensitivity around political status and age. We also held 4 informal follow-up interviews with teachers, and one teacher held brief informal interviews with 2 students. Student interviews involved a Swahili translator in most cases, and some students switched between English and Swahili in their replies. Participation was voluntary and had no effect on students' ability to participate in NPP. Although significant challenges hampered collection of post-surveys, we include open-ended responses from 40 student's post-program surveys (spanning three class sites) in our qualitative analysis.

For the U.S. study, the first author collected fieldnotes, captured images and videos of student work, and held follow-up dialogues with the teacher. Following reflexive practice [40], he also wrote analytic memos and reflections. He sought written consent from students and opt-out consent from parents with a letter that was sent home a week prior to the study. Unlike in the Kenyan study, he also helped shape the activities to align with intercultural goals, such as pairing students across 'groups' and activities which involved exchange of interests.

To analyze qualitative data, the first author coded fieldnotes and interviews in the bottom-up, line-by-line procedure of grounded theory [21] with a focus on social dynamics. Through affinity diagramming, he established themes for each study separately. The codes and clusters of the U.S. study were then compared to the Kenyan study, with a focus on peer interaction. Common codes included: "budding bonds broken up," "tensions over pairing," "attending to intergroup friction," "bonding over breakdown," and "spatial sedimentation." A U.S.-specific cluster is "white students centered" and a Kenya-specific code is "difficulties hearing" (due to noise pollution). Survey data from the Kenyan study was then compared to the resulting codes to identify common patterns or find points of divergence. In prior work on NPP, we outlined what computing in general affords for intercultural learning [7]; here we focus on social relationships and privilege the U.S. codes due to the context of readership. We present fieldnotes and participant quotes in italics.

Key to our U.S. analysis is a shift towards racial "identification" that acknowledges how, in the terms of Ehlers and Piper, we are all passing [39, 101]. This challenging and divergent orientation seeks to be reflexive about its own reification of race and to surface who is doing the identifying [8, 41]. Thus, racial identities do not arise naturally, they are developed under various social pressures and surveillance, including researcher identifications, especially when participants are children [63, 68, 77]. To combat reification, some scholars suggest to put racial identifications in quotes [29, 41, 96]. Here we follow Fields & Fields [45] in using lowercase (e.g. "black," "white," "asian,"

"hispanic") to indicate a racial *identification* of students, and we use uppercase to signal an identity.[7] In particular we use "of color" for students who were not identified as white and culturally Euro-American (i.e., a white Latina student would count as "of color"). Sometimes even when we know how students identify, we are purposely less specific to preserve anonymity, and use lowercase to surface the classifier-bundling work we (rather than the student) are performing. Note that concepts of "race" are inherently unstable [80], and even under the rubric of identity, many researchers commonly shuffle students into monolithic racial categories despite additional complexity or student resistance (e.g., [38, p. 1579-80]). The experimental practice deployed here is meant to be uncomfortable and challenge readers. To be clear, however, we believe *both* identity/ification are important, and acknowledge that our flattening is a limitation of our U.S. methods, where we did not collect a pre-survey and were unable to follow-up with participants. We return to the topic of identification in the Discussion.

In our findings we often use the term "intergroup bonding," and one might wonder how "intergroup bonding" is observed or measured. Salient indications of bonding emerge by paying attention to what students *do,* not just during activities but in the micro behaviors and choices students make during class transition periods and "gaps" in instruction [7]. These signals emerged from our data coding and included: partners sitting together unprompted at the start of class after they were paired together deliberately on a prior day; switching the mouse regularly during pair activities; positive body language (such as feet turned towards a partner [92]); asking a group member for permission or feedback; helping a partner with a non-computing task; who students exited class with; and the presence of shared laughter or giggling (social laughter triggers powerful bonding agents in the brain [82]). The absence or opposite of these signals could indicate a negative outcome –for example, pairs splitting up as soon as the activity ends or students sitting at a distance from others. We append the term "intergroup" to remind readers that each phenomenon occurred over interactions across *what adults perceive as* a contextually-significant difference. Finally, when we use the term "preparatory privilege," we mean students who signalled prior knowledge –i.e., whether by correcting the teacher about an obscure Scratch feature, announcing that they knew Scratch beforehand, bringing up a game they'd programmed prior to the class, etc.

5 LESSONS FOR SHIFTING FROM CONTENT TOWARDS RELATIONSHIPS

We organize our findings to begin from "what happened" in our contexts along an intergroup lens: (1) contextual factors that seem to impact bonding and (2) complications to the quality of intergroup bonding that went beyond normative claims of good and bad outcomes. Second, we reflect on three design strategies that we attempted to foster intergroup bonding: (1) deliberate pairing across difference, (2) interdependent programming activities that sought overcome a tension between intergroup contact and inequity in prior knowledge, and (3) deliberate activities and rhetoric in Kenyan classes that made bonding across difference a salient learning goal to students (warm-up icebreaker, conflict resolution, and intercultural competence activities).

5.1 The Context of Intergroup Bonding

Diversity in class composition is key to the quality of intergroup contact [98]. As we stated above, intercultural computing is not targeted for classes composed primarily of students in dominant social positions where a few students will feel extremely marginalized. Scholars of equity in STEM are well-aware of these dynamics, which motivate identity-specific programs. But even when

---

[7]We acknowledge the importance of capitalizing "Black" when referring to ethnic Black American or diasporic identity. Our goal is rather to surface power in (imposed) identification. This acknowledges that not all students perceived as Black may identify as such, although people in the U.S. often assume they will [68, 77]. It also acknowledges our study limitations.

challenges of diverse participation are addressed, there are other contextual factors that appeared to disrupt or contribute to intergroup bonding.

First, we observed that special events, school assemblies or exams, teacher absences, and incursions of family could disrupt the momentum of budding social bonds. For instance, a Burundian girl who stressed her excitement over learning about computers remained absent because of studying for English exams and family problems at home. Similarly, after students paired and even when they seemed to interact positively, long periods of absence, whether personal or because of school weekends and vacation periods, could forget who they were partnered with or what the group had shared between them. This suggests that strategizing around breaks, delays, or disruptions may be especially important for fostering quality interactions.

A second factor is to be reflexive about the "dominant culture" that emerges in the local classroom context [56]. In Kenya, teachers used the phrase "Great Lakes cultures" to describe this dominant cultural context[8] compared with students of Somali and Sudanese backgrounds who were often fewer in number. As prior scholars have remarked for U.S. contexts [76], power dynamics could manifest in unequal group negotiations where dominant cultural practices were centered; for instance, in Kakuma, a team of four argued over whether to represent an Indigenous Dinka medicine in a game project but ultimately decided to represent a Western medicine instead. Students privileged by the society could also come to class with prior knowledge of computing (preparatory privilege [83]). We observed preparatory privilege strongly in U.S. classes, although more along the lines of race than gender (some white or asian girls in 6th grade classes seemed just as experienced and interested in coding, which could reflect either the young age group or the shifting dynamics of 2020). This type of inequity was almost entirely absent from the Kenyan classes since refugee participants, including boys, generally had little to no prior experience with computers.

Finally, the local spatial and material context –i.e., organization of desks and the materiality of devices –can impact how easily students mingle with others and react to disruptions of social order. In the first classes, students across Kenyan and U.S. contexts generally sat with people they already knew and, to more or less an extent depending on the class composition, along lines of social groups salient to the society (i.e., Congolese students, white males, girls of color). Prior friendships and social groups then territorialized class space (seats are "claimed" and students learn who sits where over time) which then resisted new orderings and could reform, even after days of disruption. For instance, a Kenyan teacher recalled that if there was a group of prior friends, *"they were not open to participating in new groups, working with other people,"* and another stated that students even from similar backgrounds *"just don't want to be paired with someone else"* because of prior friendships. Large distances between seats could hinder peer communication while "tight" arrangements (where it is hard to move around) could facilitate communication across pairs or groups, although at the expense of the teacher's ability to navigate class and attend to students. Seating arrangements were also observed to solidify around particular machines: students could become attached to computers that stored prior work or claim locations by writing names on laptop boxes. Importantly, teachers were not always in control of designing spatial arrangements, since rooms were often shared with other classes or subject to institutional policies.

5.2 Complications of Intergroup Bonding

Prior work has revealed helping one another and shared laughter over bugs, mistakes, and breakdowns as possible contributors to intergroup bonding in computing and making courses [7, 113, 114]. In the U.S. study, we observed bonding over breakdown and humor frequently, as well as "teasing" each other through the creation of media (e.g., in an activity of drawing one's partner, a black girl

---

[8]Similarities between tribes from Burundi, Rwanda, the Democratic Republic of Congo, Tanzania, and Kenya.

Fig. 1. During a pair programming activity, a hispanic girl and a white boy create a game about helping an old woman cross the street. The scene ends with the old woman thanking the man and the man replying "vale Boomer" ("OK Boomer" in Spanish). The pair were observed giggling together over the project, but the U.S. teacher, an older male near the boomer generation, reacted negatively to the epithet.

drew her white, female partner with big red lips as a joke). But even where students appear to bond or get along, dynamics can emerge which complicated normative accounts of "positive" and "negative" social outcomes: bonding over othering and bonding with unequal control.

5.2.1 **Intergroup Bonding over Othering and Stereotyping.** Sometimes intergroup bonding occurred around instances of othering, including humor around stereotypes or epithets. For instance, in the U.S., a white boy and a hispanic girl (who had recently immigrated from South America) bonded over the creation of a game about helping an old, pale-skinned woman cross the street; without any direct instruction to do so, students chose in-game dialogue to be in Spanish. Using Google Translate to discuss and regularly passing the laptop between them, they were later observed giggling over humorous breakdowns and purposeful choices, such as the dark-skinned male sprite picking up the old woman and carrying her across the street. The researcher congratulated their efforts and attended to other pairs. However, upon viewing their work, the teacher found the game included the phrase "vale Boomer" ("OK Boomer" in Spanish) that he thought disparaged older generations of which he was a part (Fig. 1). He scolded the pair for their choice and encouraged them to remove the epithet. This appeared to demotivate the pair the next day, with the boy hiding his face in his arms and adopting an oppositional attitude. In this choice, the teacher's resolution of friction may have negated their social bonding by problematizing the outcome of their interaction.[9]

Other teachers could take the opposite tact and embrace humorous dynamics around stereotypes after noticing they were not hurting others. In Kakuma, one teacher recounted how students, especially when someone made a mistake, called each other by names of food related to their cultural background. At first he was skeptical, but ended up embracing the teasing himself:

> *"It was making people laugh, okay. Our students laughed. Even the one that was given the name could also laugh. It was not a matter of imitating somebody, or abusing somebody... So, they could even go, 'Oh, she has failed, 'omena!" meaning that Congolese, you eat omena [a fish]. 'Oh, kisra.' Kisra is a kind of food which is eaten by people from South Sudan... When I saw that, I thought it was abusing somebody or it was aggressive. But I observed it and I could see that no one was annoyed... And so, I used to change [how I*

---

[9]'OK Boomer' has been used by young adults and teenagers, particularly those marginalized by U.S. society, to critique the attitudes of the (particularly white) baby boomer generation; however, we acknowledge that this phrase also exists in a context of rising ageism worldwide [85]. The teacher's reaction to the essentializing phrase may be a combination of his socioeconomic status and prior challenges to his authority in other interactions with the white student in the pair.

> *addressed students to keep them attentive]. If it's Congolese, instead of saying omena, then*
> *I used to say kisra, or chapati for a Somali student. [The student would reply], 'No, no, I'm*
> *not chapati. No, that [other] one!'"*

Here, the teacher contested notions of purity by deploying a tactic of hybridity that sought to blur the boundaries of reified identity [50]. In informal interactions, people can "play" with group stereotypes as a bonding mechanism; in this type of humor, the friction of stereotypes can "open shared understandings of the underlying assumptions of dominant frames" in order to "destabilize them through making those assumptions visible, and laughable" [149]. As these examples illustrate, the line between what is truly othering and what brings people together is not always clear. Teachers must balance whether to condemn prejudice or stereotypes expressed towards others (e.g., older generations or ethnic groups) with the potential benefits of acknowledging and supporting –rather than shutting down –bonding that occurs around it. These situations also express complications with projecting researchers' and teacher's sense of ethics and political correctness onto students [123]. While the provided examples were relatively mundane, in other cases these dilemmas can be stark. For instance, in Nairobi, a group of 3 students across nationality and tribe came up with a game about reclaiming stolen lands through violence; one interviewed member, recently displaced, had ample reasons to argue for war. Here teachers –who were refugees themselves –chose not to question the game's narrative or redirect the team. In the U.S., an analogous scenario might be students of color bonding over a game which advocates harm towards police officers.

5.2.2 **Intergroup Bonding with Unequal Control.** Prior work in elective computing classes suggested that students under-represented in computing elect not to participate to avoid ostracization in nearly-all white classrooms [91]. This suggests that white students actively express prejudice or avoid interacting with students of color. Yet we found that in some intergroup pairings, bonding appeared to occur while partners of color are relatively less engaged in activities and white students are centered through preparatory privilege and/or assumptions of dominance [83]. In other words, negative dynamics could re-emerge *even when students were ostensibly getting along and bonding across difference.*

A common case was a white student who controlled the computer for almost the duration of a pair programming activity with a girl of color and where the pair were otherwise seen laughing, bantering or smiling together. Although largely males, this dynamic also appeared within female pairings. Here is one example of these dynamics during a two-day Scratch activity:

> *Kemi (black) and Jeff (white) are giggling over their screen while Jeff controls the computer.*
> *I come by and ask, "What's the scenario?" Kemi looks up and tells me, "We're fine."*
> *Struggling to do something, Jeff rotates the male sprite upside down. They both laugh.*
> *Jeff clicks something and Kemi laughs harder: the man is now laying on his side in the*
> *street... Later in the class, Jeff is slamming his finger into the Chromebook touchpad on the*
> *stop sign (likely because the laptops are slow). "We need more time cause we're laughing,"*
> *Kemi tells me. The next day, Kemi has her knees on her chair, her feet oriented towards*
> *Jeff with his blue hood up. They are again chatting as Jeff controls their laptop.*

As this incident suggests, a black student may signal that they believe computing is not "for" them even while bonding with a white student around a computing task. Their collaboration is still "around" the making of computational artifacts, but much less "through" the making of them. Following the pathbreaking work of Paula K. Hooper, we remind readers how racist messages from the media, school and peers, as well as lack of representation and invisibilized histories of Black American scientists [84], often signal to students of color that computing is not for them [9, 67, 83, 100]. The student with preparatory privilege may also make it easier to spur or

encode humorous scenarios, since they are likely to experience less frustration while programming. Importantly, we do not mean to imply the quality of bonding was especially deep or something Kemi would have chosen to do absent the school context; however, the dynamic could emerge.

We stress that not all interactions where a white student bonds with a student of color are negative, nor does helping require forcefully taking control of a computer. For instance, in one exceptional case a white boy, Mark, and a black girl, Yasmine, appeared to be prior friends, sitting near one another, bantering, and teasing each other. Like some white males in the course, Mark demonstrated high competency with Scratch –but so did Yasmine, who often dominated control of the computer when paired with other students, including white students. In one exchange around movement for a sprite, Mark calls the researcher over (a common occurrence):

> *"Can you show her how to not glide [use move blocks instead of glide blocks]?" As I approach, April, a white girl across from the pair, turns her laptop around and tells Yasmine, "See you should do it like this." "See watch," says Mark, clicking the arrow keys on April's computer. Yasmine says, "I want to do that help me." She turns her laptop towards Mark. As he makes changes, Mark teases Yasmine over not knowing the right block to use.*

Power dynamics emerge in this interaction, but Yasmine also signals her interest –"I want to do that" –and her agency in commanding Mark to show her how. Yasmine's granting of permission to Mark is different than Mark taking control of her computer unasked. In other interactions, Yasmine was paired with April, and generally directed the interaction.

5.3 Design Strategies for Fostering Bonding across Difference

Here we explore responses to intentional design decisions meant to foster bonding across study sites: deliberate pairing strategies which upset normalized social order; a new activity type that sought to address unequal power dynamics over pair programming; and activities which made intercultural learning an explicit goal in Kenyan classes.

5.3.1 **The Practice and Tensions of Intergroup Pairing.** One of the key design strategies of fostering intergroup bonding is to mix students. But to break up social order, teachers must make deliberate choices and commands. These expressions of power often face resistance by students when grouping across gender and ethnicity or breaking up friendships. They also require potential trade-offs between intercultural and computational learning goals that teachers must balance.

Many Kenyan teachers expressed few reservations at breaking up order and countering student resistance. Teachers often cited their own learning to interact across difference as their motivation. During an observed class in Kakuma, one teacher separated students with direct commands: *"Some of you, you're [seated beside] the same nationalities, I am going to change you." He addresses students by name and commands, 'Go sit there!' pointing to chairs across the room."* At another site, a teacher reflected on how he mixed students early on to disrupt intragroup pairings and friendships:

> *"When I came I let them sit [where they wanted]. But I rearrange them after... I can see, they wanted to make a line for female only, and a line for boys only. And then I say 'No! You have to sit with your brother!'... You see where [a Somali girl] is sitting with [a Sudanese boy]? There were another [Somali girl] that was absent who was sitting there... But I said, 'No, you have to mix up.' Then [the boy and girl] come and sit and then today they are working very well on Scratch."*

These cross-ethnic, cross-gender pairings could correspond to self-reported new friendships in post-survey, including the referenced pair. For instance, when a Somali girl who made friends with a Dinka boy was asked how her interactions with students changed over time, she stated: *"the first*

time I meet with [other students] I can feel bad, but [now] I can talk with them"; and the boy, who also reported her as a friend, wrote *"now I see things different to what I could see before about culture."*

Other teachers exhibited discomfort around pairing. In the U.S., the white male teacher expressed discomfort with deliberately pairing students of color with white students or breaking up prior friendships; to distance himself from the process, he passed out numbered popsicle sticks to randomize students and pointed to places in the room, calling out numbers. This method had a chance to pair those who were already friends. We emphasize that prior intragroup friendships did not automatically mean distraction, but a few friendships did appear to distract students. Reacting to these dynamics, in a later class Mr. M paired students deliberately. Two black girls resisted:

> *Mr. M is telling students where to sit when they come in, stopping them and pointing to tables. "I need you to sit there," he says. Tiana, a black girl, spins around. "Why?" "Sit there," says Mr. M, pointing to the bottom-left table. As more students shuffle in, Mr. M. directs Alyssa, a black girl whom Tiana is prior friends with, to the back-right table... "Oh my God," Alyssa says, moving to the seat. Other students seem upset about the assigned seats, and the class is noisy. Mr. M asks the class to settle down. Alyssa raises her hand and Mr. M calls on her. "How come we have assigned seats?" The teacher sighs. "Because I needed to have people away from their friends today." Alyssa, who had stuck by Tiana for the last two activities, sighs dramatically. Mr. M says something about being honest.*

On a prior day, Tiana was observed positively collaborating with a white girl, while when paired with Alyssa could be distracted by conversation. After this split, Tiana engrossed herself in designing a Hero's Journey maze for her dance teacher, drawing a stick figure with long wavy hair surrounded by students; later she asked the first author for feedback. Meanwhile, Mr M. attended to Alyssa and the white girl beside her, who were later seen laughing together while leaving class.

This example surfaces the tension between breaking up intragroup friendships for marginalized youth and intercultural goals. Yet the example also illustrates a further point: teachers do not simply exercise power in groupings, they often have to provide *reasoning* for why. This is especially important for marginalized youth, who learn to be suspicious of authority figures and assert agency through resistance [96, 115]. Mr M.'s reasoning for disrupting social order (first ignoring Tiana's *"why?"* and then, *"I needed to have people away from their friends"*) expressed a desire to avoid conflict and obscure the reasoning, which is different than reasons given by teachers in Kenya who were explicit about their (and the program's) intentions for intergroup bonding. For instance, when asked how they countered resistance, a Nairobi teacher recalled: *"We told them the importance of team work and helping each other to learn... I remember we did it by force sometimes, usually saying, 'You have to stay with this person.' But like... [even when] forcing the person, telling the person the importance of that."* When a Somali girl in Kakuma complained about being paired with boys outside her cultural background, another teacher stressed the importance of intercultural communication: *"I told her that, 'This is the way it should not be... it's good to know each other's cultures. We may never understand if we're not communicating with boys... I'm South Sudanese. You will know my name only, but you will not know my background, so we have to communicate."* Even when one teacher gave up splitting students, he *"started showing them why we are doing the warm-up activities"* and claimed the students sat of their own accord with unlike others later into the class. Such cross-gender and cross-cultural pairings could later align with mutually reported new friendships in post-surveys; had teachers not encouraged students to be open to new interactions and countered initial resistance, it is unlikely these friendships would have occurred.

This leads into two broader concerns over grouping students: *how much* and for *how long*. On the one hand, regularly mixing students seemed to have positive effects: some students met and learned they got along well together, while other pairs that did not work out (whether because

of control inequities or just differences in personality) could feel secure in the knowledge that it was temporary. On the other hand, mixing up groupings too much could break up intergroup pairs who seemed to get along well, disrupting the potential for deeper bonding. For instance in Nairobi, a Congolese boy who expressed his interest in becoming friends with a S. Sudanese partner did not write the latter boy's name in a post-survey question about making new friends –even though he listed eight other names. In the U.S., a white boy randomly paired with a hispanic girl told to the teacher, unprompted: *"I thought it was fun –working with someone I couldn't communicate [as well] with."* The pair would then come into class and sit together, but gradually drifted away from each other after split up by random pairings.

Although less common, we did observe prior intergroup friendships in classrooms, such as white girls being prior friends with girls of color. Teachers responded to prior intergroup friendships in various ways. Many appeared to overlook them, although a few let prior intergroup friends remain together, viewing them as occasions to support, rather than disrupt. Typically, however, prior intergroup friends were broken up over randomization techniques for pairing. In these cases, the method and scaffolding of grouping students again becomes important –randomization can break up existing intergroup friendships, but separating existing friendships during shorter activities, especially early on, may contribute to network bonding effects.

We speculate that a strategy of early mixing, followed by deliberate, longer-term pairings by an attentive teacher (who observes what students seem to get along, which hold certain social capital, which have social anxiety, etc.) may be better at fostering positive intergroup interaction. To do this, however, teachers must be willing to exercise commands in classes and utilize their social intuition when grouping students. While these expressions of power may be uncomfortable and error-prone, countering students' resistance to pairing could result in bonding that may otherwise not have occurred, especially when sustained over multiple weeks.

5.3.2 **Interdependent Programming.** Consistent with prior U.S.-based work [83], we observed tensions between students' prior knowledge which fell along racialized and gendered disparities in the society. In the U.S., this divide was particularly prevalent among white boys and girls of color, where some white boys came to class with high levels of prior knowledge and in pair activities dominated control of the computer. Above differences in prior knowledge, this assumption of dominance and centrality is a manifestation of whiteness [106]: at very young ages, children in the U.S. learn to be biased towards whiteness, behaviors and beliefs entrenched by social segregation and cultural representation [124]. From observations of these interactions, we designed a new type of activity called "interdependent programming." In an interdependent programming activity, students are grouped and work independently (on their own laptops) but the activity requires active sharing of information between collaborators. This is distinct from, though similar to, a 'jigsaw' or 'hybrid' method where each student in a diverse group is responsible for separate pieces of a larger project [94, 147]. We tried two different activities, "Drawing One Another" (where pairs drew each other to learn drawing in Scratch) and "My Partner's Hero's Journey" (where pairs coded each other's maze games around a personal hero). Both were modifications of MyCS [46] activities and the latter similar to a maze activity from the Kenyan program.

We focus on the multi-day "My Partner's Hero's Journey" activity to illustrate more general observations of pairs across both activities. During this activity, a black girl, Jordan, was randomly paired with Evan, a white boy. Jordan appeared to be prior friends with other white and hispanic girls she sat with; in prior activities, she was often patient and engaged and appeared to hold similar knowledge of Scratch to many students in the course. Meanwhile, Evan, who was usually quiet and attentive to helping other students, had corrected the teacher on two occasions, indicating high prior knowledge of Scratch. These students were observed collaborating closely on the first day

of the activity, where the teacher remarked positively on their work. On this day, Evan encoded Jordan's hero, her mother and two challenges her mother faced –Jordan's birth at a young age, and attending college –while Jordan encoded Evan's hero, a teacher from the school who had experienced bad teachers (Fig. 2). After four days' break in between the continuation of the activity, the researcher interacted several times with the pair:

> *As I pass by, Jordan asks if I want to see her maze. She clicks the green flag and moves her sprite, a woman, to the end of maze where she reaches another woman –whom she says represents a 'good teacher.' But the sprite says nothing. She appears confused. Noticing this state of affairs, Evan starts to explain something to her, then shifts the laptop towards him and shows her how to fix the code.*

In this interaction, despite focusing on his own screen, Evan noticed Jordan was confused and sought to help her; he had been observed doing so on the previous day when she was unsure how to color a backdrop. Note that in earlier, standard pair programming with a different white boy, the other boy had dominated control of the computer, even after multiple reminders to share control by the teacher and researcher, leaving Jordan with less time to practice on Scratch. Now her partner shared expertise without removing the ability for her to work independently. But the narrative of the game could be lost during the interaction:

> *After she debugs the issue, Jordan calls me over to playtest her game again, but I ask her what the story is about before we play. She looks around for Evan's worksheet; he sees this and hands me his sheet, but I ask her again if she remembers. "I know it's been awhile." Jordan says suddenly: "it's about his teacher's story going through the sixth grade and her challenges of [encountering] a bad teacher and becoming a good teacher."*

Here, having spent four days away from a single day's activity, Jordan *appears to have* forgotten the content of her partner's maze, despite appearing engaged in finishing it. Under pressure, she remembers the story. Later, Evan expresses a similar forgetfulness:

> *I notice that Jordan and Evan aren't interacting as much today –each is focused on their own screens... After walking around, I return and ask Evan to show me his maze. First I ask him what it's about. He looks for Jordan's worksheet on the table top, finds it, and explains using her worksheet as a guide: "Oh, [Jordan's] mom had her at a young age, and then [her mom] went to college which helped her."*

There are multiple potential reasons for why students might forget, such as the delay or, possibly in copying Jordan's drawing into the game, Evan overlooked the personal narrative the game represented. Yet partner's hesitation might also be interpreted as *nervousness* around misrepresenting their partner's narrative (e.g., after the class, the teacher stated, *"Look at how well they were working. I think they didn't want to screw up each others work"*). Indeed, even in the other U.S. class which was typically noisy, students appeared noticeably quieter and engaged during the latter days of the Hero's maze activity. Yet the next interaction with Evan surfaces how preparatory privilege might cut off the potential for deeper bonding or understanding:

> *As I leave their pair, Evan smiles and tells me that he's been working on something "more complicated than this" outside of class that he's proud of. "It's a platformer game." I ask him what it's about. He says it doesn't have a story like this game.*

Shortly after and into the following day, Evan was seen working on that personal game instead, while Jordan continued to expand her partner's maze by adding a purple obstacle that disappears when the protagonist touches the word "6th grade." (This behavior mimicked a feature Evan had added, where Jordan's mother, after touching Jordan's sprite and the word "college," would remove yellow obstacles.) Rather than seeking Jordan's critique of his representation or using it as an
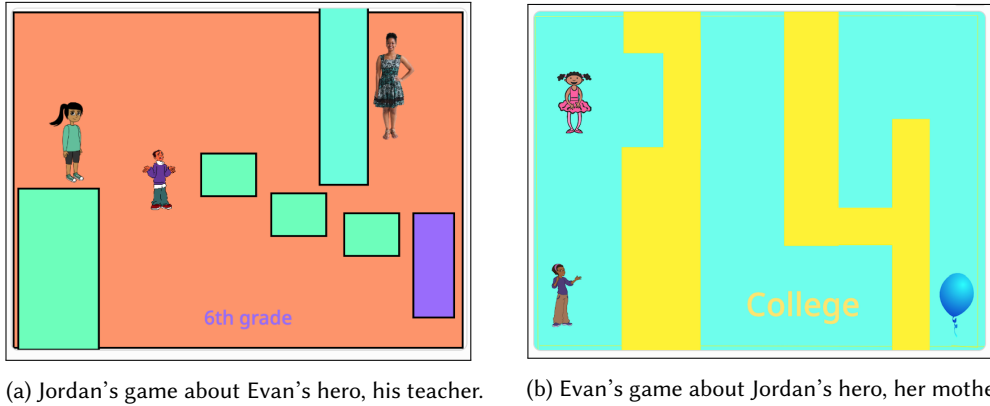
(a) Jordan's game about Evan's hero, his teacher. (b) Evan's game about Jordan's hero, her mother.

Fig. 2. Two partners –a black girl, Jordan and a white boy, Evan –create games of each other's heroes and the obstacles they faced. The depicted games are the final versions.

opportunity for further collaboration, Evan reverted into individualized play and signaled a belief in what is "more complicated" as having higher value (possibly to signal his competency to an authority figure whose presence represented the white male majority in CS), rather than powerful narratives or social bonding. Though Evan helped his partner and, at least on the surface, learned more about her background, he signaled that he valued code complexity and demonstration of technical competence above all. Later that day and into the next, Jordan was eager to demonstrate her learning to the researcher and teacher; however, the exchange of experience was still limited and reproduced power dynamics (albeit perhaps in less extreme ways).

Although this muted interaction around My Partner's Hero's Journey was similar to other pairs, another reading suggests this activity's design could be improved to address the later behaviors we observed. In the activity, individuals translated their hero narrative into a maze drawing before passing it to their partner, concretizing a copyable blueprint. In an alternate design, their partner could be made responsible for the translation process, requiring regular dialogue between partners. Moreover, students could be asked to present their game in an open playtest –holding them accountable to speaking respectfully and accurately about their partner's hero and framing the activity as a site to practice understanding and empathy, in addition to computational knowledge of "broadcast" blocks and event handling. Even so, still broader pedagogical changes may be required for making the shift towards relationships in computing classrooms.

5.3.3 **Making Relational Goals Explicit: Icebreaker, Conflict Resolution, and Intercultural Competence Activities.** The story of Jordan and Evan suggests that U.S. students, particularly in dominant social positions, valued the demonstration of technical knowledge above all, signaled by Evan's comment about knowing "more complicated" coding skills. Rhetoric about tech pipelines, Eurocentric and individualistic notions of success (and detached abstraction) that devalue community and environmental connection [87], as well as media representations of white male "hackers," are important dynamics Evan may have been reflecting. The U.S. study targeted intergroup bonding with changes to existing activities over Scratch, but intergroup goals were rarely made explicit to participants through deliberate scaffolding and targeted activities. By contrast, the Kenyan program made intercultural learning an explicit goal of the class.

In retrospect, these design choices may be significant. In the Kenyan program post-survey, all students were asked what they had learned in the course before being asked more specific questions about intergroup bonding. 20 out of the 40 students reported learning intercultural competence

or communication skills alongside computing knowledge (e.g., *"I learned how to create a game and how to interact with other people from different origins"*). Of the 38 students that specified ethnic origins, 32 reported making at least one cross-national friendship, 26 wrote at least one cross-gender friendship, and only 6 reported solely intra-gender, intra-national friendships. There were indications that these friendships did not naturally arise by virtue of a diverse classroom. For instance, when asked whether she learned anything from the course important to her everyday life, a Rwandan girl replied: *"Most of the work you do in a group. You have to communicate. And you also have to understand each other. You're taught to appreciate each other's opinion."* The student further explained that most of her new friends were made not from pair or group programming, but from the warm-up activities *"because you had to ask each other questions."* Similarly, when a Kenyan boy was asked why he was making new friends including Congolese, Rwandan, and S. Sudanese students, he stated: *"Because [the teacher] was* making us *interact with each other. Each and every day he* made us *into new groups.... Even when he brought up physical games [like Mancala] we got to interact"* (emph. added). A popular interest for students were differences in languages, particularly hearing tribal languages that were less common; icebreaker activities on "hello" in different languages and different ways to count to five were cited as sparking this interest.

Along with students, teachers frequently cited the warm-up, icebreaker activities for contributing to intergroup bonds. For instance, when a teacher was asked whether students would have bonded as well in other, more traditional computing classes, he replied: *"No, no, no. It's not that much [in other classes] because there's no warm-ups. There's no converging aspect [of friendships] because everyone knows... that this is my computer."* In other words, screens distract students from interaction and solidify seating arrangements; class activities apart from the computer that encouraged interaction seemed to counteract these effects (e.g., 'acting out code'). Other teachers reported observing students become more open to interaction as classes went on and attributed this change both to time spent in the class (about five weeks) and the non-computing icebreaker or warm-up activities.

Beyond warm-ups, teachers in Kenya also employed various strategies to encourage students in intercultural learning goals, such as appealing to their own experience with cultural difference, their shared refugee status, being culturally responsive to the shared local context (e.g., seeing someone get stung by a scorpion for an activity about empathy), or making explicit connections between the conflict resolution activities and class dynamics. For example, one Kakuma teacher deliberately grouped 3 students from the Nuer tribe in the middle of the room, and added a Somali student who knew Swahili and English. Then he asked the group to encode a conversation in Scratch, and told the surrounding classmates to watch. Predictably, the Nuer students spoke in Nuer and the Somali student *"started complaining."* When a boy tried to translate for her into English, his Nuer partners shifted him back to their tribal language. The teacher turned to the class. *"So, how do you feel if you meet some people, they're only talking in their languages but you cannot understand?"* This occurred right before an activity where groups of students would encode a conversation about cultural difference between sprites in Scratch. The teacher's pedagogy is reminiscent of Werner et al.'s strategies for positive pair programming [141].

6   DISCUSSION

Justice often requires coalitions of people to come together across difference to fight for a common cause. Some of the most important issues –climate change, economic inequality, access to healthcare, and the refugee crisis, to name a few –will require broad coalitions to advance solutions. But to build coalitions strong enough to challenge power requires understanding and respect even across disagreements. Rather than framing all friction as something to be avoided, people must be able to interact even when interactions are initially uncomfortable and risk conflict. It is the resolution of that emergent, intercultural friction which facilitates transformative change [43].

Computing education is still a relatively young field. Understandably, the vast majority of research has focused on designs and strategies for improving conceptual knowledge and attitudes of all people towards computing, especially for those traditionally under-represented in U.S. contexts. Scholars have developed pedagogy to engage youth, whether by appealing to their interest in social justice, valuing their insight and knowledge, or responding to their cultural practices [36, 91, 112]. These shifts are powerful and important work, and much more needs to be done, particularly with professional development for teachers around culturally-responsive and justice-oriented pedagogy. Where our intercultural approach differs is its chief concern about the quality of social bonds across difference, and how to design computing spaces as positive sites for fostering such bonds. We are still concerned about the quality of CS instruction and justice-oriented activities, but our objective is rather to view computing spaces as a *medium* through which social and culture exchange, learning, and bonding occur between and among students that counteracts divisions present in the wider society. As with Allport's contact hypothesis [98], the question is thus not whether to apply an intercultural approach, but rather *in what context*, *with what class composition*, and *with what structure* building bonds across difference becomes viable.

Although U.S. and Kenyan contexts are different in myriad, important ways, perhaps the most salient difference across our studies was the preparatory privilege of some white students, which resurfaced old tensions between intergroup contact and unequal dynamics downstream from structural inequities. Like other scholars, we again observed unequal interactions over group activities [83, 91, 114, 135], but we also observed scenarios where students appeared to bond even over unequal dynamics. This reminds us that intercultural and computational learning goals do not automatically align −e.g., there may be scenarios where bonding occurs at the expense of other learning goals −which challenges us to design solutions which mitigate power differences while continuing to provide opportunities for intergroup contact. Our trial of a new activity type, interdependent programming, seemed to soften negative power dynamics while still enabling contact, but deeper understanding and empathy across difference appeared muted, and while the activities could be better designed and guided in future work, we suggest the explicit 'intercultural' framing of computing classes (and their learning outcomes) appeared to be a significant factor in some of the new friendships that students reported in the Kenyan program. This suggests that future designs should explore framing intergroup interactions as *challenges* for students to embrace and involve activities which teach them *how* to attend to friction that emerges. Computing activities then *become* −and are not automatically by virtue of diversity or justice topics −sites for students to practice attending to emergent friction and build solidarity across difference. Most importantly, students can then utilize their own agency in advancing solidarity across difference −not just during group activities, but in gaps in instruction and outside the classroom context entirely.

In the following sections we reflect more on tensions and complications that emerged from our findings, reconnect to our third concern about identifications, and outline some limitations.

6.1 Tensions between Intergroup Contact and Equity Goals and Strategies

Our observations of pair programming align with studies which show unequal, racialized and gendered dynamics [4, 76, 83, 91, 114]. Prior work on inequities in pair programming have suggested an array of factors which affect pairing quality, such as gender, prior closeness, attitude towards collaboration, or working with partners of unequal ability [78, 79, 140]. Several studies focus solely on gender and avoid analysis (or even mention) of ethnicity or race (e.g., [23, 33, 78, 141]). For instance, Denner et al. state that students generally picked same-gender friends, note demographics but provide no details about inter-ethnic pairing, and conclude that "middle school students will benefit from programming with a partner" regardless of differences in prior knowledge [33]. Our observations of white students with preparatory privilege and students of color suggest these

findings are limited to situations in which students pick pairings and echo calls for intersectional analyses of social dynamics [4, 47, 108, 114, 120]. Here, we observed that social bonding does not correspond linearly with equal dynamics over computing activities.

The tension between intergroup contact and equity reflects larger shifts in critical pedagogy in U.S. contexts. Without attending to justice topics, intergroup contact risks becoming a "vehicle for the maintenance of order by resolving conflict, meanwhile leaving injustices unresolved" [56, p. 522]. Pedagogies of resistance thus stress deferring to the agency and voices of marginalized students, sometimes in radical ways, in order to combat power differentials [115]. One common argument in the U.S. is to not separate students of color [124]. For instance, Gorski recalls an event where students would be "forcibly integrated, coerced into celebrating diversity by sitting with classmates racially or ethnically different from themselves" [57] and dismissed the idea after students of color expressed discomfort. Programs to combat inequity in computing have also deployed strategies of segregation which facilitate belonging for marginalized students. Our design tactic of grouping students, derived from work in peace education [116], appears in tension with these arguments. Across contexts, we observed students of all backgrounds resistant to grouping across difference, yet despite this initial resistance, positive interactions and bonding could emerge.[10]

We stress that intergroup contact is not meant to be a universally "better" approach, but rather must keep in mind context, composition, and structure. Class compositions where a few students face extreme marginalization are not our target and may be better served by encouraging social affinity. So too may our approach be better suited to settings in which nearly all participants share a marginalized status, as in the Kenyan program. The teachers in Kenya were refugees themselves, and thus could appeal to students' status, while the white teacher of the U.S. class represented the dominant social group, and thus could not claim as strong of a shared identity with students of color. Future work could explore guidelines for what tactic to apply given input conditions. Although we acknowledge the concerns of scholars [56, 124], we believe justice and intergroup contact are not mutually exclusive endeavors and that in some cases, bridging division can itself be an act of justice [68]. To help combat inequities, however, future work might explore a tactic of asymmetric mixing, whereby marginalized students remain together but a few dominant-group students join them.

6.2 Dilemmas in Attending to Friction

Teacher's ability to attend to emergent conflicts in classes is central to intercultural learning efforts. Prior work explored complications of interactions over social justice group projects [91, 132, 133]; here, we suggest that intergroup bonding can arise over othering or stereotypes. Our findings around humor intersect with studies of humor in computing pedagogy [113, 114]. Beyond being a source of joy, we found that students can use stereotypical associations as material for humor, or otherwise "tease" their partners through the creation of coded media. These incidents can raise complications and dilemmas for teachers and academics wary of transgressing norms of correctness. While humor around stereotypes is often negative and can reify bounded, essentialist notions of cultural difference, it can also act as a bonding agent, blur boundaries, and express the development of intercultural competence [126, 143, 144]. In a study of multi-ethnic school children, for instance, Reid found that "ethnic and racial differences can become the very material from which banter and laughter are created, constituting a convivial sociality that manifests closeness at the same time as difference" [143]; and Wise describes encountering "ironic racism" in a multinational, male

---

[10]We note that the U.S. study, where we observed racialized unequal dynamics, was disrupted by the 2020 global pandemic right before student final projects. Thus although it was a goal to facilitate project groups over social justice topics, this aspect of the U.S. study does not appear in our data.

workplace as initially "outright and unequivocally offensive... But listening back... these men were almost passionate in describing this as evidence of... how great it was to belong in this way" [144, p. 490]. A prime example of humor around intercultural friction is the *Key and Peele* TV sketch "Substitute Teacher," where a black substitute teacher pronounces white students' names in Black English (e.g., "jay-quellin" for Jacqueline). The sketch surfaces cultural norms of middle-class Euro-American classrooms and challenges their dominance, as the teacher refuses to code-switch. In our classes, students themselves could express humor that challenges cultural boundary-making:

> *The Burundian teacher shares a cultural conflict with the class: a South Sudanese woman would click with her tongue when the instructor asked "are we together?"... The teacher asks Nimo, a Somali girl: "What do you do when someone calls you [to attention]?" Nimo, standing, waves at him with her hand beneath her chador. "No, in your mother country," the teacher adds. "We say 'heyyyy'," replies Nimo, smiling widely.*

The dilemmas presented by bonding over othering and stereotypes are part of broader complications for teachers attending to student conflicts, such as conflicts over the authority of experience [66, 70, 125, 130] or contested narratives [15]. Educators and researchers adopting an intercultural approach must be reflexive on their own political beliefs and try not to let these override student agency [9], to essentialize students, or to automatically shut down intergroup bonding over what one deems politically incorrect [111]. This may be especially difficult in a political context where identity politics has gained prominence to challenge power structures. hooks advocated a liberatory pedagogy that calls for moderation: to critique "those perspectives that insist that experience has no place in the classroom" but also to acknowledge how the "authority of experience" can be used to "silence and exclude" as "both stances can create an atmosphere of coercion and exclusion" [66, p. 86]. Similarly, Asare advocates an anti-racist pedagogy that challenges Black American students' authority of experience on racial injustice, designing content that is "intellectually destabilizing, by design" to not render their learning needs "invisible" by assuming they are experts [8].

6.3 Designing Computing Education Spaces for Contact and Exchange

Recent studies have asked for future work to pay a deeper attention to intergroup relationships [114, 130, 133]. We suggest here that paying attention to relationships should address, but also go beyond the teacher's role: curricula should explore deliberate scaffolding and structure to facilitate contact and prepare participants for navigating friction themselves. When designing scaffolding, we have found it worthwhile to separate out intercultural learning goals from computational learning goals. One can imagine a course for intercultural competence where computational knowledge is barely taught; by contrast, computational learning may be achieved without social bonding. Separating these goals can also reveal tensions between them; for instance, conflict resolution activities could take significant time away from teaching computing concepts. The big, open question is whether intercultural learning *and* computational learning can be achieved at once. To do so asks us to look for alignments between intercultural and computational learning goals and design activities and scaffolding to address both simultaneously. This includes the alignments of culturally-responsive computing [36], but must go beyond a focus on identity and also focus on the quality of peer interactions across difference. In designing the Kenyan program, we did not always align these learning goals: sometimes intercultural activities were "extra" or apart from computing concepts, such as an activity on managing conflict.

To provide an example of a future 'aligned' activity, one might frame a lesson on conflict resolution around social media. Social media has drawn criticism for amplifying division [48]; even in justice activism, several critics have raised concerns around mob mentality, lack of empathy, and the potential to abuse accountability processes (e.g., [69, 70, 109]). Queer theorist Schulman argues

that activists should not to conflate all conflict with abuse, be wary of mirroring their oppressors' behaviors, and carry "a duty of repair" [117]. An aligned activity might ask students how to alter or reimagine social media to diffuse escalation of conflict or apply restorative justice principles [104].

Our work has also raised the scaffolding questions of *how much* mixing should occur and for *how long* groupings of students should persist. Prior work on group composition and pair programming focuses on how to group students to optimize individual learning [33, 78, 148], but the usual assumption is that pairs persist for the duration of a class. Consistent with larger trends, the vast majority of this work also frames social relations as a means to an end rather than the ends themselves [133]. For Kenyan classes, a strategy of regular, early mixing over short tasks disrupted social order, instilled a norm around that disruption, and encouraged students' openness to bonding that seemed to contribute to later bonding and snowball effects in forming social relations. There also appeared trade-offs in each strategy: e.g., longer time together can overcome initial tension, but it may also cement discomfort. To balance tensions between intergroup pairing and student agency, future curriculum design might explore a hybrid approach (i.e., randomized group activities balanced by other activities that let students pick partners) that expresses a "dual categorization" strategy of prejudice reduction [94]. Another alternative scaffolding that future work might explore is that of intergroup dialogue [59], where students are initially segregated across some social difference and prepared with activities about reflection, conflict resolution and active listening.

Finally, educators should consider spatial and material contexts and, if possible, alter arrangements if they are less conducive to interaction. Interactions should not just be within pairs or groups, but across groups; and teachers should be aware that where certain students are seated may reinforce power dynamics (e.g., marginalized students sitting in corners away from others [76]). Educators should also design against disruptions: activities that stretch across multiple days can support deeper bonding between students than one-off, quick activities; however, weekends and other breaks can disrupt the momentum of bonding.

6.4 Reflections on Shifting to Identifications

We return now to the third concern of intercultural computing and reflect on what 'racecraft' and acknowledging our role in 'identification' means for interpreting our studies, as well as computing and STEM education more broadly. Although beyond the scope of this paper, readers should be aware that racecraft challenges some dominant discourses of anti-racism (for similar views, see [8, 49, 68]). For instance, while Gilroy acknowledges the important role that U.S. critical race theory has played in counteracting damaging color-evasive rhetoric, he cautions against some of its adherents' "extreme attachments to a reified notion of race" [50, p. 145].

We acknowledge that 'refugee' and 'nationality' are a political statuses. Children marked with them can operate in a cultural borderlands. Even though students wrote an ethnic category when asked on pre-surveys, it sometimes emerged that they held partial identities or held little background in the culture they identified with due to being born in Kenya –raising concerns about bounded, static notions of culture [60, 61]. The reader might thus take issue with our framing of certain interactions as "intergroup" and others as not. Indeed, the authors of *Racecraft* would take issue with our language themselves: their argument is that people are not "members" of "racial" groups but instead that racism created and maintains the illusion of racial groups [45]. In our U.S. study, to help surface the power dynamics of racial classification, the first author adopted an experimental practice of lowercasing racial categories when referring to his/the teacher's identifications and bundling maneuvers (versus identities, which should be capitalized). Although we still spoke of our findings in familiar terms, it would be more accurate to claim that "race" (re)emerged in U.S. classes due to unequal peer dynamics. In other words, race is *produced* from unequal interactions. As the Fields remind us, racism makes actions of perpetrators and institutions seem like attributes

of people. Race was initially advanced as a strategy to divide indentured servants from rising up to challenge the power of Anglo-Saxon, male elites [45]. Race is not a "factor" which "impacts outcomes" of students in computing independently –no matter how much it might appear so close-up. Rather, racism and its traces –actions and the rationale for those actions, both historically and in the present-day –impacts outcomes, not race [41]. This keeps our focus on the unequal *products* of social interactions [106] and calls scholars to "move beyond the angles of vision" in combating racism [49]. It echoes, too, Rankin et al.'s point (this Issue) of "saturated sites of violence" towards Black women in CS education. However, "[r]ejecting racecraft [may require] that we live in a state of non-alignment with our national political and social order" [8]. Future work might explore interpersonal racecraft as what is to be analyzed, not as the inputs to the analysis [80].

6.5 Limitations

This research involved studies of intro computer programming for youth conducted in five after-school class sites in Kenya and two public school classrooms in the U.S. Although social tension is a global phenomenon, our study contexts are still significantly different from one another, especially in the broader cultural differences across regions. In the U.S., for instance, diversity rhetoric is highly politicized through media and integrated into some school systems, while in Kenya, diversity is rarely discussed in formal schooling. Furthermore, all U.S. students were required to take the course and nearly all participants were citizens with some from high socioeconomic backgrounds; while in Kenya, all participants volunteered to join, had low economic standing, and nearly all held refugee status. These larger differences between student populations affect incoming attitudes and openness of students, interrupting clean comparisons. So too were there institutional differences: NGOs and teachers in Kenya were, while sometimes viewing the intercultural goals as secondary, more onboard with direct confrontation with social tension; while the administration and teacher in the U.S. context exhibited an aversion to direct discussion of race. Before the study was disrupted, the first author was trying to build enough rapport with the teacher to conduct an activity which directly broached racial issues, but was undermined by their outsider and younger status, as well as an institutional climate where the teacher feared reprisal by the administration should such a discussion occur (i.e., presumably by white parents hearing about it and calling in to complain). This is ironic for the school site otherwise signalled its embrace of social justice, including #BlackLivesMatter. Climates of silencing discussion of racism and marginalized experiences in CS reflect color-evasive ideology which simply perpetuates the status quo [55, 106].

The positionality and presence of the first author may also affect findings across contexts, such as not being from Kenya, not knowing Swahili, Somali, or the many tribal languages spoken in Kenyan classes, or participants changing behavior due to their presence. Our studies were qualitative and relied on data collected and interpreted by the first author; this meant that not all interactions were documented and the first author may have overlooked important dynamics, whether due to limited time, attention or perceptual biases. In particular, the method and analysis' emphasis on peer interactions necessarily downplayed individual identity development [118]. Teachers may also be eager to suppress or ignore negative dynamics in their classrooms, especially in Kenya where were paid by the NPP. In the U.S., both the teacher and the first author represented dominant social positions which may impact interactions with students of color [9].

We also acknowledge that post-survey responses of Kenyan students, especially around reported new friendships, could be subject to translation barriers and the rhetoric of the program might have subjected their responses to social-desirability bias [32]. Students also may not see social difference the same way as adults; for instance, an exceptional Congolese boy in Nairobi did not know his newfound friend was from South Sudan until interviewed, and a few participants were born into refugee status and had never lived in their parents' home countries.

7 CONCLUDING THOUGHTS

This paper established core concerns of an intercultural approach to adolescent, intro computing education that has emerged from our multi-national work to combat "othering" [102]. To move from theory to practice, we explored intro programming class in Kenya and the U.S. through the lens of intergroup contact and social bonding. We outlined contextual factors that seem to effect bonding, and detailed complications around bonding over stereotyping and unequal dynamics. We then reflected on three tactics meant to facilitate intergroup bonding –deliberate pairing across difference, interdependent programming activities, and making relational goals explicit. Ultimately, we argued that making relational goals explicit holds promise, but that intercultural learning can be in tension with equity goals. We suggest that future work look to incorporate lessons from peace education and conflict resolution to facilitate justice-oriented curricula without inflaming divides.

REFERENCES

[1] Rediet Abebe, Solon Barocas, Jon Kleinberg, Karen Levy, Manish Raghavan, and David G Robinson. 2020. Roles for Computing in Social Change. In *ACM Conference on Fairness, Accountability, and Transparency (FAT*)*.

[2] Rediet Abebe and Kira Goldner. 2018. Mechanism design for social good. *AI Matters* 4, 3 (2018), 27–34.

[3] Musa al Gharbi. 2021. Book Announcement: We Have Never Been Woke. Retrieved May 9, 2021 from https://musaalgharbi.com/2021/05/05/book-announcement-we-have-never-been-woke/

[4] Morgan G. Ames and Jenna Burrell. 2017. 'Connected Learning' and the Equity Agenda: A Microsociology of Minecraft Play. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing* (Portland, Oregon, USA) *(CSCW '17)*. ACM, New York, NY, USA, 446–457.

[5] Arjun Appadurai. 1996. *Modernity at large: cultural dimensions of globalization*. University of Minnesota Press.

[6] Ian Arawjo. 2020. To Write Code: The Cultural Fabrication of Programming Notation and Practice. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–15. https://doi.org/10.1145/3313831.3376731

[7] Ian Arawjo, Ariam Mogos, Steven J. Jackson, Tapan Parikh, and Kentaro Toyama. 2019. Computing Education for Intercultural Learning: Lessons from the Nairobi Play Project. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–24.

[8] Abena Ampofoa Asare. 2018. Exorcising "Racecraft": Toward the RaceSyllabus. *Radical Teacher* 112 (2018), 16–26.

[9] Catherine Ashcraft, Elizabeth K. Eger, and Kimberly A. Scott. 2017. Becoming technosocial change agents: Intersectionality and culturally responsive pedagogies as vital resources for increasing girls' participation in computing. *Anthropology & Education Quarterly* 48, 3 (2017), 233–251.

[10] Les Back and Shamser Sinha. 2016. Multicultural conviviality in the midst of racism's ruins. *Journal of Intercultural Studies* 37, 5 (2016), 517–532.

[11] Nilanjana Bardhan and Bin Zhang. 2017. A post/decolonial view of race and identity through the narratives of US international students from the global south. *Communication Quarterly* 65, 3 (2017), 285–306.

[12] Shrutarshi Basu, Nate Foster, and James Grimmelmann. 2019. Property conveyances as a programming language. In *Proceedings of the 2019 ACM SIGPLAN International Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software*. 128–142.

[13] Zvi Bekerman. 2007. Rethinking intergroup encounters: Rescuing praxis from theory, activity from education, and peace/co-existence from identity and culture. *Journal of Peace Education* 4, 1 (2007), 21–37.

[14] Zvi Bekerman. 2009. Identity versus peace: Identity wins. *Harvard Educational Review* 79, 1 (2009), 74–83.

[15] Zvi Bekerman and Michalinos Zembylas. 2011. *Teaching contested narratives: Identity, memory and reconciliation in peace education and beyond*. Cambridge University Press.

[16] Audrey Grace Bennett. 2016. Ethnocomputational creativity in STEAM education: A cultural framework for generative justice. *Teknokultura* 13, 2 (2016), 587–612.

[17] Milton J. Bennett. 1986. A developmental approach to training for intercultural sensitivity. *International journal of intercultural relations* 10, 2 (1986), 179–196.

[18] Milton J. Bennett. 2009. Defining, measuring, and facilitating intercultural learning: a conceptual introduction to the Intercultural Education double supplement.

[19] Jo Boaler. 2008. Promoting 'relational equity'and high mathematics achievement through an innovative mixed-ability approach. *British Educational Research Journal* 34, 2 (2008), 167–194.

[20] Rogers Brubaker et al. 2004. *Ethnicity without groups*. Harvard University Press.

[21] Kathy Charmaz. 2014. *Constructing grounded theory*. Sage.

[22] Jonna Chen. 2020. Reversing the 'Woman in STEM' Card. *The Cornell Daily Sun* (2020). https://cornellsun.com/2020/09/29/chen-reversing-the-woman-in-stem-card/

[23] Kyungsub Stephen Choi. 2015. A comparative analysis of different gender pair combinations in pair programming. *Behaviour & Information Technology* 34, 8 (2015), 825–837.

[24] Diane Codding, Chrystalla Mouza, Rosalie Rolón-Dow, and Lori Pollock. 2019. Positionality and belonging: Analyzing an informally situated and culturally responsive computer science program. In *Proceedings of FabLearn 2019*. 132–135.

[25] Black Boys Code. 2021. Black Boys Code. Retrieved May 16, 2021 from https://www.blackboyscode.com/

[26] Michael Cole. 1998. Can cultural psychology help us think about diversity? *Mind, Culture, and Activity* 5, 4 (1998), 291–304.

[27] Michael Cole, Distributive Literacy Consortium, et al. 2006. *The fifth dimension: An after-school program built on diversity*. Russell Sage Foundation.

[28] Kimberle Crenshaw. 1990. Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stan. L. Rev.* 43 (1990), 1241.

[29] Emma Dabiri. 2021. *What White People Can Do Next: From Allyship to Coalition*. Penguin Books UK.

[30] James Davis, Michael Lachney, Zoe Zatz, William Babbitt, and Ron Eglash. 2019. A cultural computing curriculum. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*. 1171–1175.

[31] Richard Delgado and Jean Stefancic. 2017. *Critical race theory: An introduction*. Vol. 20. NYU press.

[32] Nicola Dell, Vidya Vaidyanathan, Indrani Medhi, Edward Cutrell, and William Thies. 2012. "Yours is better!": Participant response bias in HCI. In *Proceedings of the sigchi conference on human factors in computing systems*. 1321–1330.

[33] Jill Denner, Linda Werner, Shannon Campe, and Eloy Ortiz. 2014. Pair programming: Under what conditions is it advantageous for middle school students? *Journal of Research on Technology in Education* 46, 3 (2014), 277–296.

[34] Adrienne Dessel and Mary E. Rogge. 2008. Evaluation of intergroup dialogue: A review of the empirical literature. *Conflict Resolution Quarterly* 26, 2 (2008), 199–238.

[35] Petula Dvorak. 2020. Is it cultural appropriation when a Black woman does Irish dance? *The Washington Post* (2020). https://www.washingtonpost.com/local/is-it-cultural-appropriation-when-a-black-woman-does-irish-dance/2020/08/03/974b16f6-d517-11ea-930e-d88518c57dcc_story.html

[36] Ron Eglash, Audrey Bennett, Casey O'donnell, Sybillyn Jennings, and Margaret Cintorino. 2006. Culturally situated design tools: Ethnocomputing from field site to classroom. *American anthropologist* 108, 2 (2006), 347–362.

[37] Ron Eglash, Juan E. Gilbert, and Ellen Foster. 2013. Toward culturally responsive computing education. *Commun. ACM* 56, 7 (2013), 33–36.

[38] Ron Eglash, Michael Lachney, William Babbitt, Audrey Bennett, Martin Reinhardt, and James Davis. 2020. Decolonizing education with Anishinaabe arcs: generative STEM as a path to indigenous futurity. *Educational Technology Research and Development* 68, 3 (2020), 1569–1593.

[39] Nadine Ehlers. 2012. *Racial imperatives: Discipline, performativity, and struggles against subjection*. Indiana University Press.

[40] Robert M Emerson, Rachel I Fretz, and Linda L Shaw. 2011. *Writing ethnographic fieldnotes*. University of Chicago Press.

[41] Zimitri Erasmus. 2010. Contact theory: Too timid for "race" and racism. *Journal of Social Issues* 66, 2 (2010), 387–400.

[42] Zimitri Erasmus. 2017. *Race otherwise: forging a new humanism for South Africa*. NYU Press.

[43] Arturo Escobar. 2018. *Designs for the pluriverse: Radical interdependence, autonomy, and the making of worlds*. Duke University Press.

[44] Barbara J. Fields. 2001. Whiteness, racism, and identity. *International Labor and Working-Class History* 60 (2001), 48–56.

[45] Karen E. Fields and Barbara J. Fields. 2014. *Racecraft: The soul of inequality in American life*. Verso Trade.

[46] CS4All San Francisco. 2020. MyCS Quarter-Length Course. Retrieved Nov 9, 2020 from https://sites.google.com/a/sfusd.edu/mycs-teacher/quarter

[47] Joy Gaston Gayles and Katie N. Smith. 2018. Advancing theoretical frameworks for intersectional research on women in STEM. *New Directions for Institutional Research* 2018, 179 (2018), 27–43.

[48] Nabeel Gillani, Ann Yuan, Martin Saveski, Soroush Vosoughi, and Deb Roy. 2018. Me, my echo chamber, and I: introspection on social media polarization. In *Proceedings of the 2018 World Wide Web Conference*. 823–831.

[49] Paul Gilroy. 2000. *Against race: Imagining political culture beyond the color line*. Harvard University Press.

[50] Paul Gilroy. 2005. *Postcolonial melancholia*. Columbia University Press.

[51] Paul Gilroy. 2009. True Humanism? Civilisationism, Securitocracy and Racial Resignation. In *Johannesburg Workshop in Theory and Criticism Salon*, Vol. 1.

[52] Cliff Goddard. 2006. Ethnopragmatics: A new paradigm. *Applications of Cognitive Linguistics* 3 (2006), 1.

[53] David Theo Goldberg. 2015. *Are we all postracial yet?* John Wiley & Sons.

[54] Joanna Goode, Allison Ivey, Stephany RunningHawk Johnson, Jean J. Ryoo, and Christine Ong. 2020. Rac(e)ing to computer science for all: how teachers talk and learn about equity in professional development. *Computer Science Education* (2020), 1–26.

[55] Joanna Goode, Stephany Runninghawk Johnson, and Krystal Sundstrom. 2020. Disrupting colorblind teacher education in computer science. *Professional Development in Education* 46, 2 (2020), 354–367.

[56] Paul C. Gorski. 2008. Good intentions are not enough: A decolonizing intercultural education. *Intercultural education* 19, 6 (2008), 515–525.

[57] Paul C. Gorski. 2019. Avoiding Racial Equity Detours. *Educational lEadErship* (2019).

[58] Barbara J. Grosz, David Gray Grant, Kate Vredenburgh, Jeff Behrends, Lily Hu, Alison Simmons, and Jim Waldo. 2019. Embedded EthiCS: integrating ethics across CS education. *Commun. ACM* 62, 8 (2019), 54–61.

[59] Patricia Gurin, Biren Ratnesh A. Nagda, and Ximena Zuniga. 2013. *Dialogue across difference: Practice, theory, and research on intergroup dialogue.* Russell Sage Foundation.

[60] Kris D. Gutiérrez, P. Zitlali Morales, and Danny C. Martinez. 2009. Re-mediating literacy: Culture, difference, and learning for students from nondominant communities. *Review of research in education* 33, 1 (2009), 212–245.

[61] Kris D. Gutiérrez and Barbara Rogoff. 2003. Cultural ways of learning: Individual traits or repertoires of practice. *Educational researcher* 32, 5 (2003), 19–25.

[62] Edward T. Hall. 1959. *The silent language.* Anchor books.

[63] Alex Hanna, Emily Denton, Andrew Smart, and Jamila Smith-Loud. 2020. Towards a critical race methodology in algorithmic fairness. In *Proceedings of the 2020 conference on fairness, accountability, and transparency.* 501–512.

[64] Lawrence A. Hirschfeld. 1998. *Race in the making: Cognition, culture, and the child's construction of human kinds.* MIT Press.

[65] Bell Hooks. 1990. Yearning. *Race, Gender, and Cultural Politics South End Press, Boston* (1990).

[66] Bell Hooks. 1994. *Teaching to transgress.* Routledge.

[67] Paula K. Hooper. 1996. They have their own thoughts. *Constructionism in practice: Designing, thinking, and learning in a digital world* (1996), 241.

[68] Carlos A Hoyt. 2016. *The Arc of a Bad Idea: Understanding and Transcending Race.* Oxford University Press.

[69] Tada Hozumi. 2019. Understanding 'accountability abuse'. Retrieved Nov 9, 2020 from https://selfishactivist.com/understanding-accountability-abuse/

[70] Emma A. Jane. 2017. 'Dude... stop the spread': antagonism, agonism, and #manspreading on social media. *International Journal of Cultural Studies* 20, 5 (2017), 459–475.

[71] The Black Experience Japan. 2019. I'm Culturally Japanese. Retrieved Nov 10, 2020 from https://youtu.be/JKMn9L6BAOc

[72] Yasmin Kafai, Chris Proctor, and Debora Lui. 2019. From theory bias to theory dialogue: Embracing cognitive, situated, and critical framings of computational thinking in k-12 cs education. In *Proceedings of the 2019 ACM Conference on International Computing Education Research.* 101–109.

[73] Yasmin Kafai, Kristin Searle, Crîstobal Martinez, and Bryan Brayboy. 2014. Ethnocomputing with electronic textiles: Culturally responsive open design to broaden participation in computing in American Indian youth and communities. In *Proceedings of the 45th ACM technical symposium on Computer science education.* 241–246.

[74] Randall L. Kennedy. 1989. Racial critiques of legal academia. *Harvard Law Review* 102, 8 (1989), 1745–1819.

[75] Michael Lachney. 2017. Computational communities: African-American cultural capital in computer science education. *Computer Science Education* 27, 3-4 (2017), 175–196.

[76] Jaime Lester, Aoi Yamanaka, and Brice Struthers. 2016. Gender microaggressions and learning environments: The role of physical space in teaching pedagogy and communication. *Community College Journal of Research and Practice* 40, 11 (2016), 909–926.

[77] Meira Levinson. 2012. *No citizen left behind.* Vol. 13. Harvard University Press.

[78] Colleen M. Lewis and Niral Shah. 2015. How equity and inequity can emerge in pair programming. In *Proceedings of the eleventh annual international conference on international computing education research.* 41–50.

[79] Paul Light, Karen Littleton, Stuart Bale, Richard Joiner, and David Messer. 2000. Gender and social comparison effects in computer-based problem solving. *Learning and Instruction* 10, 6 (2000), 483–496.

[80] Mara Loveman. 1999. Is "race" essential? *American Sociological Review* 64, 6 (1999), 891–898.

[81] Jabari Mahiri. 2017. *Deconstructing Race: Multicultural Education Beyond the Color-Blind.* Teachers College Press.

[82] Sandra Manninen, Lauri Tuominen, Robin I Dunbar, Tomi Karjalainen, Jussi Hirvonen, Eveliina Arponen, Riitta Hari, Iiro P Jääskeläinen, Mikko Sams, and Lauri Nummenmaa. 2017. Social laughter triggers endogenous opioid release in humans. *Journal of Neuroscience* 37, 25 (2017), 6125–6131.

[83] Jane Margolis, Rachel Estrella, Joanna Goode, Kim Nao, and Jennifer Jellison Holme. 2008. *Stuck in the Shallow End: Education, Race, and Computing.* MIT Press.

[84] Charlton D. McIlwain. 2019. *Black software: The internet and racial justice, from the AfroNet to Black Lives Matter.* Oxford University Press, USA.

[85] Brad A. Meisner. 2020. Are you OK, Boomer? Intensification of ageism and intergenerational tensions on social media amid COVID-19. *Leisure Sciences* (2020), 1–6.

[86] Mary Mendenhall, Sarah Dryden-Peterson, Lesley Bartlett, Caroline Ndirangu, Rosemary Imonje, Daniel Gakunga, Loise Gichuhi, Grace Nyagah, Ursulla Okoth, and Mary Tangelder. 2015. Quality education for refugees in Kenya: Pedagogy in urban Nairobi and Kakuma refugee camp settings. (2015).

[87] Cueponcaxochitl Dianna Moreno Sandoval. 2013. Critical Ancestral Computing: A Culturally Relevant Computer Science Education. *PsychNology Journal* 11, 1 (2013).

[88] Toni Morrison. 1997. "Home": In The House that Race Built, ed. Wahneema Lubiano.

[89] Jennifer C Nash. 2008. Re-thinking intersectionality. *Feminist review* 89, 1 (2008), 1–15.

[90] Jennifer C. Nash. 2018. *Black feminism reimagined: After intersectionality.* Duke University Press.

[91] Na'ilah Suad Nasir and Sepehr Vakil. 2017. STEM-focused academies in urban schools: Tensions and possibilities. *Journal of the Learning Sciences* 26, 3 (2017), 376–406.

[92] Joe Navarro and Marvin Karlins. 2016. *What every body is saying.* HarperCollins.

[93] Luis Noe-Bustamante, Lauren Mora, and Mark Hugo Lopez. 2020. About one-in-four US Hispanics have heard of Latinx, but just 3% use it. *Pew Research Center* (2020).

[94] Elizabeth Levy Paluck and Donald P Green. 2009. Prejudice reduction: What works? A review and assessment of research and practice. *Annual review of psychology* 60 (2009), 339–367.

[95] Leigh Patel and Alton Price. 2016. The origins, potentials, and limits of racial justice. *Critical Ethnic Studies* 2, 2 (2016), 61–81.

[96] Orlando Patterson. 1997. *The ordeal of integration: Progress and resentment in America's "racial" crisis.* Civitas/Counterpoint Washington, DC.

[97] Orlando Patterson. 2014. Making sense of culture. *Annual Review of Sociology* 40 (2014), 1–30.

[98] Thomas F. Pettigrew. 1998. Intergroup contact theory. *Annual review of psychology* 49, 1 (1998), 65–85.

[99] Tawana Petty. 2018. *Towards Humanity: Shifting the Culture of Anti-Racism Organizing.* CreateSpace.

[100] Nichole Pinkard, Sheena Erete, Caitlin K. Martin, and Maxine McKinney 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, 3 (2017), 477–516.

[101] Adrian Piper. 2018. *Escape to Berlin: A Travel Memoir.* Adrian Piper Research Archive Foundation Berlin.

[102] John A. Powell and Stephen Menendian. 2016. The problem of othering: Towards inclusiveness and belonging. *Othering & Belonging* 1 (2016), 14–39.

[103] Jasbir K. Puar. 2018. *Terrorist assemblages: Homonationalism in queer times.* Duke University Press.

[104] Nick Punt. 2020. De-escalating Social Media. Retrieved Nov 9, 2020 from https://nickpunt.com/blog/deescalating-social-media/

[105] Yolanda A. Rankin and Jakita O. Thomas. 2019. Straighten up and fly right: Rethinking intersectionality in HCI research. *Interactions* 26, 6 (2019), 64–68.

[106] Yolanda A. Rankin, Jakita O. Thomas, and Sheena Erete. 2021. Real Talk: Saturated Sites of Violence in CS Education. In *Proceedings of the 52nd ACM Technical Symposium on Computer Science Education.* 802–808.

[107] Mitchel Resnick, John Maloney, Andrés Monroy-Hernández, Natalie Rusk, Evelyn Eastmond, Karen Brennan, Amon Millner, Eric Rosenbaum, Jay Silver, Brian Silverman, et al. 2009. Scratch: programming for all. *Commun. ACM* 52, 11 (2009), 60–67.

[108] Sarah L. Rodriguez and Kathleen Lehman. 2017. Developing the next generation of diverse computer scientists: the need for enhanced, intersectional computing identity theory. *Computer Science Education* 27, 3-4 (2017), 229–247.

[109] Jon Ronson. 2016. *So you've been publicly shamed.* Riverhead Books.

[110] Lisa Rosenthal and Sheri R. Levy. 2012. The relation between polyculturalism and intergroup attitudes among racially and ethnically diverse adults. *Cultural Diversity and Ethnic Minority Psychology* 18, 1 (2012), 1.

[111] Howard J. Ross and JonRobert Tartaglione. 2018. *Our search for belonging: How our need to connect is tearing us apart.* Berrett-Koehler Publishers.

[112] Jean J Ryoo. 2019. Pedagogy that supports computer science for all. *ACM Transactions on Computing Education (TOCE)* 19, 4 (2019), 1–23.

[113] Jean J. Ryoo. 2019. "Laughter is the Best Medicine": Pedagogies of humor and joy that support critical thinking and communicative competence. In *Deeper Learning, Dialogic Learning, and Critical Thinking.* Routledge, 177–192.

[114] Jean J. Ryoo and Linda Kekelis. 2018. Reframing "failure" in making: The value of play, social relationships, and ownership. *Journal of Youth Development* 13, 4 (2018), 49–67.

[115] Jean J. Ryoo, Tiera Tanksley, Cynthia Estrada, and Jane Margolis. 2020. Take space, make space: how students use computer science to disrupt and resist marginalization in schools. *Computer Science Education* 30, 3 (2020), 337–361.

https://doi.org/10.1080/08993408.2020.1805284 arXiv:https://doi.org/10.1080/08993408.2020.1805284

[116] Gavriel Salomon and Baruch Nevo. 2005. *Peace education: The concept, principles, and practices around the world.* Psychology Press.

[117] Sarah Schulman. 2016. *Conflict is not abuse: Overstating harm, community responsibility, and the duty of repair.* arsenal pulp press.

[118] Kimberly A Scott, Kimberly M Sheridan, and Kevin Clark. 2015. Culturally responsive computing: A theory revisited. *Learning, Media and Technology* 40, 4 (2015), 412–436.

[119] William H. Sewell Jr. 2005. The concept(s) of culture. *Practicing history: New directions in historical writing after the linguistic turn* (2005), 76–95.

[120] Amber Solomon, DeKita Moon, Armisha L. Roberts, and Juan E. Gilbert. 2018. Not Just Black and Not Just a Woman: Black Women Belonging in Computing. In *2018 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*. IEEE, 1–5.

[121] Ramón Spaaij and Ruth Jeanes. 2013. Education for social change? A Freirean critique of sport for development and peace. *Physical Education and Sport Pedagogy* 18, 4 (2013), 442–457.

[122] Rainier Spencer. 2011. *Reproducing race: The paradox of generation mix.* Lynne Rienner Publishers Boulder, CO.

[123] Sharifa Sultana, François Guimbretière, Phoebe Sengers, and Nicola Dell. 2018. Design within a patriarchal society: Opportunities and challenges in designing for rural women in bangladesh. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–13.

[124] Beverly Daniel Tatum. 2017. *Why are all the Black kids sitting together in the cafeteria?: And other conversations about race.* Basic Books.

[125] Joanne Tien. 2019. Teaching identity vs. positionality: Dilemmas in social justice education. *Curriculum Inquiry* 49, 5 (2019), 526–550.

[126] Jaap Timmer. 2014. Figures of Fun: Humor and Stereotype in Monty Python's Depictions of Intercultural Communication. (2014).

[127] Jaleesa Trapp. 2019. *Uncovering hidden pathways.* Ph.D. Dissertation. Massachusetts Institute of Technology.

[128] Eve Tuck and K. Wayne Yang. 2014. Unbecoming claims: Pedagogies of refusal in qualitative research. *Qualitative Inquiry* 20, 6 (2014), 811–818.

[129] Sepehr Vakil. 2018. Ethics, identity, and political vision: Toward a justice-centered approach to equity in computer science education. *Harvard Educational Review* 88, 1 (2018), 26–52.

[130] Sepehr Vakil. 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 (2020), 87–115. https://doi.org/10.1080/07370008.2020.1730374 arXiv:https://doi.org/10.1080/07370008.2020.1730374

[131] Sepehr Vakil and Rick Ayers. 2019. The racial politics of STEM education in the USA: interrogations and explorations.

[132] Sepehr Vakil and M.M. de Royston. 2018. How "social justice" became unjust in a youth hackathon. *Power, equity and (re) design: Bridging learning and critical theories in learning ecologies for youth* (2018), 1.

[133] Sepehr Vakil and Maxine McKinney de Royston. 2019. Exploring Politicized Trust in a Racially Diverse Computer Science Classroom. *Race Ethnicity and Education* 22, 4 (2019), 545–567.

[134] Sepehr Vakil and Jennifer Higgs. 2019. It's about power. *Commun. ACM* 62, 3 (2019), 31–33.

[135] Shirin Vossoughi, Paula K. Hooper, and Meg Escudé. 2016. Making through the lens of culture and power: Toward transformative visions for educational equity. *Harvard Educational Review* 86, 2 (2016), 206–232.

[136] Polly O. Walker. 2004. Decolonizing conflict resolution: Addressing the ontological violence of westernization. *American Indian Quarterly* (2004), 527–549.

[137] Colleen A. Ward, Stephen Bochner, Adrian Furnham, et al. 2001. *The psychology of culture shock.* Psychology Press.

[138] Vron Ware and Les Back. 2002. *Out of whiteness: Color, politics, and culture.* University of Chicago Press.

[139] Alicia Nicki Washington. 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*. 213–219.

[140] Linda Werner and Jill Denning. 2009. Pair programming in middle school: What does it look like? *Journal of Research on Technology in Education* 42, 1 (2009), 29–49.

[141] Linda L. Werner, Jill Denner, and Steven Bean. 2004. Pair Programming Strategies for Middle School Girls.. In *CATE*. 161–166.

[142] Thomas Chatterton Williams. 2019. *Self-Portrait in Black and White: Unlearning Race.* W. W. Norton & Company.

[143] Sarah Winkler Reid. 2015. Making fun out of difference: Ethnicity–race and humour in a London school. *Ethnos* 80, 1 (2015), 23–44.

[144] Amanda Wise. 2016. Convivial labour and the 'joking relationship': Humour and everyday multiculturalism at work. *Journal of intercultural studies* 37, 5 (2016), 481–500.

[145] Marisol Wong-Villacres, Arkadeep Kumar, Aditya Vishwanath, Naveena Karusala, Betsy DiSalvo, and Neha Kumar. 2018. Designing for Intersections. In *Proceedings of the 2018 on Designing Interactive Systems Conference 2018*. ACM,

45–58.

[146] George Yerousis, Konstantin Aal, Thomas von Rekowski, David W. Randall, Markus Rohde, and Volker Wulf. 2015. Computer-enabled project spaces: Connecting with Palestinian refugees across camp boundaries. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, 3749–3758.

[147] Hans Yuan and Yingjun Cao. 2019. Hybrid Pair Programming - A Promising Alternative to Standard Pair Programming. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education* (Minneapolis, MN, USA) *(SIGCSE '19)*. Association for Computing Machinery, New York, NY, USA, 1046–1052. https://doi.org/10.1145/3287324.3287352

[148] Baichang Zhong, Qiyun Wang, and Jie Chen. 2016. The impact of social factors on pair programming in a primary school. *Computers in Human Behavior* 64 (2016), 423–431.

[149] Zara Zimbardo. 2014. Cultural politics of humor in (de) normalizing Islamophobic stereotypes. *Islamophobia Studies Journal* 2, 1 (2014), 59–81.