

# The Potential of CR-SE for K-12

## Computer Science Education: Perspectives from Two Leaders

Zitsi Mirakhur, Cheri Fancsali,  
and Kathryn Hill

This interview examines the close connection between equity and computer science (CS), and Culturally Responsive-Sustaining Education (CR-SE). The conversation speaks with emergent leaders in CS and provides insights into how they are bringing CS education to New York City's 1.1 million students, and how they understand and enact CR-SE practices in their work.

I ncreasingly, computing and technology permeate almost every aspect of our lives. The demand for a technologically skilled workforce is growing rapidly (U.S. Bureau of Labor Statistics, 2020), and thinking computationally is increasingly considered a necessary skill for success in today's society (Wing, 2016; Grover and Pea, 2018). Despite this, many people have historically been underrepresented in the field of computer science, including women; Black, Latinx, and Indigenous people; people from low-income backgrounds; individuals with disabilities, and English language learners (National Center for Science and Engineering Statistics, 2019). Further, the well known 'digital divide' that disproportionately affects these same groups has been exacerbated by COVID-19 (Vogels et al., 2020).

Computer Science (CS) for All initiatives around the country are attempting to address these disparities by fostering equitable access and participation in CS education (Margolis & Goode, 2016). Central to this goal are ensuring that all students receive meaningful, high-quality CS instruction at school, and developing reliable and holistic assessments to measure student achievement in CS—which to date have generally been available only for advanced high school CS courses (DeLyser et al., 2016.). Ron Summers and Christy Crawford are leaders in New York City's CS4All initiative, which seeks to bring CS to the City's 1.1 million public school students. In this conversation, they provide an overview of CS education in NYC and highlight the importance and promise of culturally responsive practices for enriching students' classroom experiences and outcomes.

**Interviewers:** To begin, please tell us about your backgrounds, your experiences as computer science (CS) teachers, and your current role?

**Ron Summers:** I was born and raised here in New York City—in Brooklyn and Queens—and attended public schools. Although my schools were not able to offer me and my classmates any tech-rich experiences, they did offer me comfort in my community and pride in being African American. I love being Black because it was part of my early schooling.

I also have first-hand experience in the tech industry from working at IBM. I saw, in the early 2000s, how much monetary value tech expertise had and this prompted me to ask, "Why am I making corporate America rich and not my own community?" That questioning led me to become a teacher in NYC—and doing it and loving it, for ten years.

I have a background teaching high school CS, in software and user interface development, but also the entrepreneurial piece, which I think is the most important. I believe that entrepreneurial thinking is the key to solving problems, [especially] while applying the "fail fast" approach that startups use to build some great product ideas into thriving enterprises. I do not want students to just build cool stuff; I want them to build cool stuff that can become businesses to fuel economic mobility and change their lives.

An important reason why I wanted to teach CS was connected to my own experiences—I thought it was important for tech readiness and creativity to be present in schools of color and not just [as an] afterthought to state testing. Success was and still is defined

for me as student empowerment. My students flourished and did some pretty amazing things: Some started viable businesses via my incubator program, others won entrepreneurship competitions organized by the Network for Teaching Entrepreneurship (NFTE), and others developed phone applications for dyslexia. I was able to provide exposure, access, and belonging in computational thinking, an entrepreneurial mindset, and a design process to students on a classroom scale—and this empowered my students to walk into rooms they never had access to, while knowing they belonged there! My job now is to do that on a scale for 1.1 million students. That is what I call full circle.

**Christy Crawford:** Similar to Ron, I transitioned into my career as an educator from another field. I was a producer for NBC News. But I left television after the death of my father, a life-long educator and former NYC teacher. I realized a more positive change could be made in the world through teaching. I taught 2nd and 3rd grade, here in NYC—in Harlem and the Bronx—for more than a decade. Interestingly, it was strongly suggested to me [by my principal] that I begin teaching a “technology course.” And so, I did it: I tackled my fear, watched YouTube video after YouTube video to learn more and found I could be of service to lots of kids who were ready to create with tech, not just be consumers of tech. Like many scholars of culturally responsive pedagogy suggest (Ladson-Billings, 1994; Gay, 2010), I learned about my students’ interests. I found out, for instance, that my students had a drum class they loved before mine. They were constantly tapping on their desks in my classroom. So, we used that positive energy! We started tapping out our [programming] code to make sure we didn’t miss a single character in our long lines of code. It worked so well that 3rd graders who would not be able to navigate such advanced or tedious coding were able to jump into programming websites!

In my experience as a teacher, I found that often children who did not excel in traditional subjects excelled in my tech class. Children who did not necessarily wait for directions, those who were fearless, ready to press any button or try anything, were the perfect students for CS. Serving those children became my passion.

As a part of the CS4All initiative, my role is to make sure that teachers are armed with pedagogical strategies that recognize that differences [between people] should be treated

as an asset for teaching and learning (Freire, 2000; Ladson-Billings, 2014) and, and that there are real practical plans of action for equitable classrooms in CS.

**I: Before we talk about CR-SE, could you give us an overview of what CS education looks like at schools across NYC?**

**RS:** We first have to confront the idea that CS has a history that is not so clean, right? There is racism and sexism there. There are just so many “-isms” that are involved in this idea that “CS is mine” and one size fits [all]. But we know that’s not true, and I think if you take a deep look at the CS4All initiative’s portfolio, what you’ll see is that our approach is around the idea that one size does not fit all. We focus on the [CS instruction] *options* that we can provide a school or community school district so they can figure out what is right for the students and community that they serve.

This means that we have different course offerings by grade-level. Our integrated unit curriculum gives elementary and middle school teachers the tools to incorporate CS instruction into their English, science, social studies, or math lessons. At the high school level, students take “standalone” CS courses, which can be a semester to a yearlong, and range from introductory to Advanced Placement CS classes. I know we’ll be talking more about CR-SE in CS shortly but I’d like to note that all of [CS4All’s] curricula and materials are designed with attention to guidelines from New York state on CR-SE practices (New York State Education Department, 2018) as well as the equity and inclusion standards that the Computer Science Teachers Association has laid out for CS teachers (Computer Science Teachers Association, 2020).

So, if you imagine it, a school leader and teacher can walk into our [CS] “grocery store,” think about what they need to actually serve their community, and that’s what they take [back to their schools]. And it doesn’t mean they get the recipe right the first time. There



**A question that teachers should ask themselves when self-assessing their classroom environments is: “Do my classroom routines and protocols support deeper learning for all students?”**

are a few iterations until they find that right mix [of instructional offerings for their school], and then we just hope that they're cooking at that point!

**CC:** There is another piece here. In NYC, CS4All is a districtwide Mayoral Equity and Excellence initiative. In other words, there is a team of people—including Ron and myself—who support the work of schools and teachers to implement culturally responsive CS curricula across the City. This is a team led by people who are not afraid to talk about and tackle racial inequities. We work with administrators to pull in more teachers (who are trained in CR-SE) and children of color into CS. We're explicit about inequities; we know we can strategize ways to eradicate systematic “-isms.” We know that there are places all around the U.S. where individuals don't want to admit there's a problem. This will

not happen in this mayoral initiative.

As a [central office] staff, we have engaged in CR-SE study together because, as Gay (2013) explains, our beliefs will shape our actions. A CR-SE mindset helps our [CS4All] team mem-

bers build experiences for educators (and in turn, students) that are inclusive and engaging. It is often a reminder that strong, positive relationships are necessary in order for students to be willing to take big risks in the classroom.

**I: Could you say a bit about what led the CS4All team in NYC to place an emphasis on CR-SE in the CS curriculum?**

**CC:** To disrupt inequity in the U.S., it is necessary to talk about race, power, and history. However, if you are studying CS in college, it may be unusual for [faculty] to talk about racial literacy in CS even though they go hand in hand. As far as I know, one exception to this is a series of workshops that were offered at Stanford University by Dr. Howard Stevenson and Mutale Nkonde. What we're saying is, “You know what? This conversation needs to start at the K-12 level. By the time [students] get to college, it may be too late.” So, we're following Daniels et al. (2019) in articulating what racial literacy means for CS. First, we want teachers (and, subsequently, their students) to have

an intellectual understanding of how structural racism operates—whether it is through algorithms or social media platforms—and how it might show up in technology that doesn't even exist yet. And then, we're hoping to build emotional intelligence about how we deal with race and racially stressful situations. I mean, this is what all teachers were hoping to get in college [courses]. If we did not do this now . . . it would be unethical.

To put this in more concrete terms: I see protesting on the street, but there is also a lot of digital activism here. I feel like what our [curriculum] gives kids is a new medium to express themselves. Let me give you an example. A few years ago, my 4th grade students were angry about the portrayal of Haiti in the news. They noted that mainstream news reports on Haiti failed to mention the strength, wisdom, and value of this nation. Students decided they would build websites to change some of the public perception of Haiti—so they could “take back” the narrative. My students then invited caregivers and community members into the school, not only for a community convening on Haiti, but also to teach their elders and friends to create their own websites so they would not be at the mercy of mainstream media that may devalue their culture. This shows that kids don't just have to be consumers of technology. To borrow from Ladson-Billings (2014), students were building their sociopolitical consciousness by using their classroom knowledge to identify and help solve real-world problems.

To answer the original question, it would be unbelievably inappropriate if kids in NYC didn't have CS with CR-SE. Without it, we're not equipping kids for this new civil rights movement. It's like going to school without a pencil.

**I: So, what does CR-SE look like in a CS lesson or in a CS classroom? How, if at all, is this different from the way we think about CR-SE in other disciplines?**

**CC:** Before diving into what CR-SE looks like, I want to add one more thought about the importance of CR-SE in CS classes. As in STEM classes, there are often Brown and Black children or women with impostor syndrome in CS classes (Rosenstein et al., 2020). They are wondering, “Do I really belong here? No one here looks like me.” Not only are they dealing with impostor syndrome, but also they're dealing with stereotype threat (Steele, 1997; Kumar, 2012). You have kids who are so nervous they may be the only one: the only girl, the only



**Drop the checklist  
and realize you  
can't do everything  
all the time.**



Puerto Rican, the only African American. The only whatever in a certain classroom. They worry, “What if I make a mistake? Will I live up to the worst stereotypes that my teacher or classmates may have about people like me?” That is unbelievably difficult, no matter how old you are. So, we’re saying with CR-SE in CS: It is incredibly important to beat back impostor syndrome and stereotype threat.

To your question about what CR-SE looks like in a CS classroom, two things stand out to me. First, relationships. Teachers implementing CR-SE spend a great deal of time building trust and positive relationships. They realize that before they get to the rigor of CS, these actions are necessary (Ladson-Billings, 1995). This may include a teacher taking the time to survey her students or holding focus groups in order to understand their strengths, comfort levels, likes, and dislikes—around and beyond CS. Then, this teacher should use that information to build her lessons. This will help cultivate trust with her students—and cultivating trust is paramount. When there’s a matter of trust, kids don’t mind failing. They think, “I can iterate again and again and again.” But think about it: If you don’t have trust, you don’t want to fail in front of somebody!

The second principle I’d point to is the sharing of authority. If we were to go into a classroom, you may not necessarily know who’s the boss, right? Who’s the teacher? Who’s the facilitator? We’re saying this is a group effort where the child has a real voice and a real value—as Gay (2013) says, it’s a way of developing students’ agency, efficacy, and empowering them. This means that students are frequently leading their class, showing others how to get “unstuck” while programming or sharing a new line of code to trick out a website about something they love. It may mean a group of students form a “Help Desk” to assist others, rather than waiting for the teacher to come to the rescue when there is a problem.

Finally, to address your question about whether or not CR-SE in CS is different than in other disciplines: It shouldn’t be. It’s not much different than in other subject areas . . . it should be the same in any subject where it’s being used. It’s simply that in STEM fields, where the numbers of Black, Brown, and female students are few, a CR-SE mindset is essential to increase the diversity of students in these subjects.

**RS:** Christy, I one hundred percent agree with you on that. I think we’re definitely holding our ground and sticking to our

values in that we will not accept CR-SE that is checkbox-y. We are really clear about this: If you’re practicing CR-SE, you’re asking yourself a set of questions. How will this lesson be delivered? How will it then affect my planning? Everything from, you know, simple things that we did as teachers. Teachers are asking, “What does my grouping look like? How am I thinking about the ways in which the system has set up this kid and said his ability level is set?” Teachers are saying, “I know my students, so I know what they’re going through, and I’m making sure they are in the best position.” And then actually taking that information back home with them to think about the next lesson and what they need to change. To me, this is similar to what Gay (2010) is getting at when she says that culturally responsive teaching is both “routine” and, simultaneously, “a radical proposal” (pp. 26-27). Teachers are filtering curriculum content through the lens of more than middle-class and White students and are making explicit the importance of students and their backgrounds. That’s where I think we are in a different place because we will not falter when it comes to encouraging and supporting strong CR-SE practices.

**I: As Ron mentioned earlier, students receive CS instruction in different ways across the K-12 spectrum in NYC. To what extent are the principles of CR-SE that you are helping teachers develop specific to certain grades?**

**RS:** This is an interesting question. CR-SE does not look different in each grade band, it’s how grade bands approach student learning that looks different, and that’s how you embed your CR-SE. So, an elementary school teacher is definitely thinking about student learning in a very different way than a high school teacher is. And, as I just mentioned, what we’re trying to do is give her the foundation, like the questions she should ask herself before she applies her own knowledge, pedagogy, and expertise to each specific situation. For instance, Gay (2013) suggests that a question that teachers should reflect on is whether or not there are specific beliefs about different groups of students that are embedded in pedagogical practices a teacher might want to implement. So, a teacher might ask herself, “Why am I putting this student in this group? Do I fully understand their strengths in programming, or am I making assumptions about their abilities based on the fact that they have an IEP?”

**CC:** To add to what Ron said, a group of teachers and I created a “study guide” for teachers based on Hammond’s (2015) book. This guide gives teachers specific questions they should reflect on—and I’m using Hammond’s (2015) language here—to build their culturally responsive mindsets, to cultivate learning partnerships, to support students’ intellectual growth, and to create an environment that is safe for learning. We see all of these tenets as important parts of culturally responsive teaching. For instance, a question that teachers should ask themselves when self-assessing their classroom environments is: “Do my classroom routines and protocols support deeper learning for all students?” So, although the classroom practices will be different for 2nd grade teachers relative to 12th grade teachers, all teachers can use this question as a starting point to take stock of their classroom environments—and to make improvements.

**I: Could you give me a few examples of what culturally responsive lessons might look like in CS classrooms across the K-12 spectrum?**

**CC:** Absolutely. Part of CR-SE is a commitment to talking about social justice and the management of stressors for children. We’ve had kindergarten teachers who have done lessons about animation focusing on self-love and expression. Here, a teacher showed a clip from the film, “Hair Love” of a dad doing a little girl’s hair and then had each child design their own [face and] hair in [the programming language] Scratch. She had children talk about and become the owners of terms that define their skin color. Discussions about skin color in the early grades may be difficult. Kids may not actually color themselves the color that they are; they may color what’s “popular” in a community, but their teacher understands and teaches them to and through their personal and cultural strengths (Gay, 2013). So, here we had a teacher who was pushing her students: “Yep, you’re right. This is beautiful skin. What are we going to call it? Is it peanut butter? Mocha brown?” There was a real sense of ownership, and in kindergarten, 1st grade, 2nd grade . . . self-love through the smog of “isms” is a revolutionary act. The difference might be in a 10th or 11th grade class where students are looking at the police data in their neighborhood. They’re looking at the number of arrests at a certain time, like when they’re going to school in the morning, and then using

data science to compile the data and then build models to show community leaders in their area. The action may look different, but the philosophy is the same.

**RS:** And, Christy, you also touched on this idea of how an understanding of CR-SE really creates a CS classroom that’s more alive than ever for the students. Because we’re tackling the actual problems that exist in our world, as scholars of culturally relevant education suggest (Ladson-Billings, 2014), and we’re not solving some silly slope problem dealing with a guy trying to jump over a hill in Lake Tahoe, right? Students get to say, “There’s this issue where I can’t walk down the street. I wonder how prevalent that is? Let me look at the data. Let me compare the data to those who are in Park Slope [an affluent neighborhood in Brooklyn]. Wow, there may be a problem here. I wonder how I can use CS to actually create some type of solution? I’m now going to go to AP CS class, or I’m now going to go to college and study CS. I’m going to come up with the new algorithm that is going to be fair and just so that some of this profiling won’t happen.”

**CC:** If you took a look at our newest course for middle school students—it’s called Critical Computing—kids also study a social category or identity. It could be national origin, gender, socioeconomic status, ability, race, family structure . . . and they discuss how they can advocate with and for this group. That’s what school is about, right? Supporting students who are looking critically at their environment and seeing where they can be of help is an important way in which we implement a culturally responsive pedagogy (Ladson-Billings, 2014). This is really digital youth activism at its best. Here, CR-SE in CS means we’re getting rid of the typical class presentation tri-folds. We’re getting rid of the dioramas. And we’re . . . allowing kids who have big ideas about identity, policies, and justice to bring the issues they care about to the world stage.

**RS:** Yeah, and do you mind if I add one more thing? We’re still learning how to do this thing. Yes, we’ve had a lot of success with the curriculum that our team has created and the work that Christy has pushed. But we’re still learning how to operationalize it in a way that is scalable for all 1.1 million students in NYC. Every community school district is different, and every district has a different definition of what equity means and what CR-SE means. An initial part of our work with districts, in line with what Gay (2013) suggests, will be to support them



in identifying what their priorities are. In other words, we are here to help district staff develop and articulate their commitments—whether to racial/ethnic, gender, socioeconomic, or other forms of equity. And then, I think that the next part of our work will be testing, iterating, and seeing what strategy sticks, but also trying to normalize a conversation around equity in CS that all of our districts can understand. And then we can create solutions.

**I: I'd like to follow up the point you just made, Ron. Scalability is an important consideration for the CS4All initiative in NYC. What are some ways in which you and your team ensure that the depth and breadth of CS knowledge and CR-SE practices are growing?**

**RS:** We understand that before you can ramp or scale up a strategy, it needs to work first. Do you start with breadth before depth, or the opposite? These questions are more challenging when we think about the intersection of race, gender, and bias within CR-SE practices and personal experience. Christy has been really smart about considering how simultaneous attention to breadth and depth are needed, because our teachers are at different points in their equitable practices journey. Scalability for us is currently focused on testing what builds efficacy at the teacher and school level and then pulling out those learnings to develop guidance and expectations that a district system can use to move the work of equitable CS and CR-SE practice.

**CC:** I'd like to build on what Ron said by giving you an example. We recently designed and implemented the first rounds of our "Exploring Equity in Computer Science" course for teachers, which included 83 co-conspirators [i.e., CS teachers across NYC]. These teachers have various levels of understanding of CR-SE and very different levels of proficiency in racial literacy. But, they are all engaging in at least 40 hours of synchronous and asynchronous work to further their understanding of racial literacy (Stevenson, 2014; Hammond, 2015), universal design for learning (Israel et al., 2018), and translanguaging (Vogel et al., 2019; Vogel et al., 2020) although we hope that teachers will continue to study with us for years to come. As a part of this training, teachers spend considerable time doing introspective work as well as examining their own racial socialization and comfort level when discussing race before diving into lessons. This is a process

that teachers with all levels of expertise can benefit from.

Our co-conspirators will not only turnkey learnings to others in their school building, but the lessons they bring back to us or the CR-SE resources they create will help us train new CS teachers throughout the city. They will help us build a strong ecosystem in CS.

**I: At the individual classroom level, what are some challenges that teachers face in making their CS instruction more culturally responsive? What kind of advice do you give teachers in such situations?**

**RS:** I just have a quick line that I use: It's okay to not get it right the first time." I think when folks hear CR-SE, it becomes loaded, right? And people ask, "Am I going to make the wrong racial statement?" Or, you know, "Am I going to approach a child in the wrong way?"

You've got to let your guard down—just like your kids, hopefully, are letting their guard down! And it's not going to be perfect on that first iteration. [CR-SE is] something that you're going to get better at. And I'm not the only person making this argument! In fact, Gay (2013) argues that teachers have to resist their and others' resistance to CR-SE and that a culturally responsive teaching practice is a developmental process—it is learned over time. In a similar vein, Ladson-Billings (2014) asserts that if teachers get to a place of "complete certainty and assuredness" about their practice, they will stop growing—and their students will wither (p. 77). It's important for us to keep growing.

**CC:** Oftentimes, teachers are very overwhelmed. They're looking for a checklist to make it easier. There is no checklist for CR-SE. There are, however, a series of what Freire (2000) called humanizing pedagogies that we particularly love that work well with a CR-SE approach such as universal design for learning (Israel et al., 2018) and translanguaging (Vogel et al., 2019; Vogel et al., 2020) These asset-based pedagogies offer practical assistance for teachers. Drop the checklist and realize you can't do everything all the time. There are so many things included in CR-SE because it's just good teaching. You have to focus on a couple of things that you can humanly maintain with CS in CR-SE.

**I: What, if anything, do we know about the short- and long-term impacts of CR-SE in CS classrooms? What have you learned anecdotally from your experiences and from supporting teachers in NYC?**

**CC:** I will say that teachers continually come back to us with reflections about kids that they didn't know much about, information about kids that wouldn't open their mouth in

CS class because of shyness, disinterest, or lack of understanding. [Teachers have] learned ways to engage and push children who did not typically take an active role in CS. They tell us that a few children who were not apt to share in class now feel as if they are in a place that is emotionally and intellectually safe enough to act as class standouts or leaders.

**“**  
**We want teachers (and, subsequently, their students) to have an intellectual understanding of how structural racism operates—whether it is through algorithms or social media platforms—and how it might show up in technology that doesn't even exist yet.**

CR-SE practices have enabled many of our teachers to recognize the CS champion or draw out the CS champion who was sitting in front of them all along.

**RS:** Much of our CR-SE work has only been really implemented over the last couple of years, so we're still waiting to be able to crunch some of that data to be able to see, you know, at a system-level, how has our curriculum done?

**I: As Christy mentioned earlier, CR-SE in CS is important to the CS4All initiative in NYC because it can be a way to empower students and give them a voice. How have you already seen this in action? And how do you hope students use their knowledge to make their classrooms, schools, or communities more just?**

**CC:** Of course, those final projects that we see students complete are great examples. But [student voice] even comes out in something like a hackathon where kids get a community problem, and then they race to come to a solution using CS. This is a way, as Gay (2013) suggests, of connecting in-school learning to out-of-school living! Then, of course, [students' solutions are] introduced to some celebrity or politician. When they get to see that adults sit

up and listen, it really has kids thinking. It's sort of the civics lesson that all children should have the chance to experience.

**RS:** Yeah, you hit it right on the head, Christy. If we did our job right, they're ready to disrupt institutionalized systems of oppression with covert histories of racist practices! It's a lesson that we didn't necessarily always have [in school], but our students today are able to take skills that they learn in CS and they're not afraid to break some stuff and say, "That's not right. And I think I have a better solution." Those are the examples that we see when we go visit schools having their end-of-year CS fairs.

To answer the second part of your question, if our culture of CR-SE was effective, what I hope to see are clubs that are open and have different hues that are represented, see student councils that are using CS to solve problems that are happening in their school buildings and outside the walls of their schools. I would hope to be able to see classes—or sequences of classes—that aren't just about access to AP [CS], but where the CS experiences and skills together are setting kids up to flourish when they leave high school. In a way, this sounds like a utopia. But this is the utopia that we want, right?

**CC:** I agree with everything Ron said and I will just add this. There is a push in the CS community to say, "You need CS" or "You'll be successful if you take CS." Sometimes, comments are made as if Black and Brown children are lacking in something—and CS must come to the rescue. But many of our students are raised to be resilient. They have the wisdom of several generations who have dealt with inequity head-on. Buolamwini (2017) talks about failed artificial intelligence technology, such as self-driving cars that may hit Brown and Black people because they don't recognize pedestrians of color. We go to hotels to talk about CS, and we can't wash our hands in the hotel bathroom because the sink sensors do not detect the color of our dark skin. This happens because, as Buolamwini's (2017) research shows, companies that are building these products are using datasets that are either overwhelmingly lighter-skinned or datasets that ignore underrepresented groups. CS needs [Black and Brown] kids to be in decision making positions to create inclusive products and systems. These kids, it's not that they need CS: CS needs them. We need these wise children to be part of the equation that serves all of society.

## Interviewers' Parting Thoughts

As our conversation with Ron and Christy highlights, implementing the principles of culturally responsive pedagogy into CS instruction has the potential to enrich students' school experiences by fostering stronger relationships between students and their teachers, increasing students' interest and engagement in the content, and making learning more relevant and personalized. Some of the academic work that Ron and Christy draw on has been distilled into audio and video resources that are available on the NYC CS4All website: [cs4all.nyc/equity](http://cs4all.nyc/equity). CS teachers can find sample lesson plans, for students of all grade-levels, by navigating to the "Resource Center" section of this site. The "Remote Equitable Practices Teaching Guide" (also available in the Resource Center) has insights, encouragement, and resources that will likely be helpful for all teachers who are navigating virtual instruction during (and beyond) the COVID-19 pandemic. For an additional set of CR-SE resources that are not directly linked to CS, teachers can sign up for emails from Zaretta Hammond, whose book *Culturally Responsive Teaching and the Brain* has shaped some of Ron and Christy's work.

In addition to creating a fulfilling academic experience, Ron and Christy highlight the potential of CR-SE in CS to provide students with the tools, voice, and agency to succeed outside the academic sphere—whether in their personal lives, professional endeavors, or as citizens in our democracy. As schools and districts across the country expand their CS offerings, we have the opportunity to infuse culturally responsive practices in all aspects of this work—from professional development for teachers to classroom activities and assessments for students. In fact, as part of our evaluation of the CS4All initiative in NYC, we are investigating the ways in which CR-SE is enacted in CS instruction and its influence on students, including social-emotional outcomes such as students' confidence, sense of belonging, rejection of stereotypes about who CS is for, and engagement in CS. We hope this conversation is a starting point for a broader dialogue about how the field of CS can be more inclusive of and responsive to all individuals, and the promise this holds to help make our schools and communities more equitable.

## References

- Buolamwini, J., & Gebru, T. (2018). Gender shades: Intersectional accuracy disparities in commercial gender classification. *Conference on Fairness, Accountability and Transparency*, 77-91.
- Computer Science Teachers Association. (2020). *Standards for computer science teachers*. <https://csteachers.org/teacherstandards>.
- Daniels, J., Nkonde, M., & Mir, D. (2019). *Advancing racial literacy in tech: Why ethics, diversity in hiring, & implicit bias trainings aren't enough*. Data & Society Research Institute. <https://racialliteracy.tech/>
- DeLyser, L.A., Mascio, B. & Finkel, K. (2016.) Introducing student assessments with evidence of validity for NYC's CS4all. *Proceedings of the 11th Workshop in Primary and Secondary Computing Education*, 17-26.
- Freire, P. (2000). *Pedagogy of the oppressed*. Continuum.
- Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). Teachers College Press.
- Gay, G. (2013). Teaching to and through cultural diversity. *Curriculum Inquiry*, 43(1), 48-70. <https://doi.org/10.1111/curi.12002>
- Grover, S., & Pea, R. (2018). Computational thinking: A competency whose time has come. In S. Sentence, E. Barensen, & C. Schulte (Eds.), *Computer science education: Perspectives on teaching and learning in school* (pp. 19-38). Bloomsbury Academic.
- Hammond, Z. (2015). *Culturally responsive teaching and the brain: Promoting authentic engagement and rigor among culturally and linguistically diverse students*. Corwin.
- Israel, M., Shehab, S., & Wherfel, Q. (2018). Increasing science learning and engagement for academically diverse students through scaffolded scientific inquiry and Universal Design for Learning. In M. Koomen, S. Kahn, C. Atchinson, & T. Wild (Eds.), *Towards inclusion of all learners in science teacher education* (pp. 201-211). Sense Publishing.
- Kumar, A. N. (2012). A study of stereotype threat in computer science. *Proceedings of the 17th ACM Annual Conference on Innovation and Technology in Computer Science Education*, 273-278.
- Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children*. Jossey-Bass.
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465-491.
- Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: a.k.a. the remix. *Harvard Educational Review*, 84(1), 74-84.
- Margolis, J. & Goode, J. (2016.) Ten lessons for computer science for all. *ACM Inroads* 7(4), 52-56. <https://doi.org/10.1145/2988236>
- National Center for Science and Engineering Statistics. (2019). *Women, minorities, and persons with disabilities in science and engineering: Special report NSF 19-340*. <https://ncses.nsf.gov/pubs/nsf19304/>
- New York State Education Department. (2018). *Culturally responsive-sustaining education framework*. <http://www.nysed.gov/common/nysed/files/programs/crs/culturally-responsive-sustaining-education-framework.pdf>
- Rosenstein, A., Raghu, A., & Porter, L. (2020). Identifying the prevalence of the impostor phenomenon among computer science students. *Proceedings of the 51st ACM Technical Symposium on Computer Science Education*, 30-36.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 52(6), 613-629.
- Stevenson, H. (2014). *Promoting racial literacy in schools: Differences that make a difference*. Teachers College Press.
- U.S. Bureau of Labor Statistics. (2020). *Computer and information technology occupations : Occupational outlook handbook*. <https://www.bls.gov/ooh/computer-and-information-technology/home.htm>



Vogel, S., Hoadley, C., Ascenzi-Moreno, L., & Menken, K. (2019). The role of translanguaging in computational literacies. *Proceedings of the SIGCSE (Special Interest Group in Computer Science Education) 2019 Technical Symposium*, 1164-1170.

Vogel, S., Hoadley, C., Castillo, A. R., & Ascenzi-Moreno, L. (2020). Languages, literacies and literate programming: Can we use the latest theories on how bilingual people learn to help us teach computational literacies? *Computer Science Education*, 1-24.

Vogels, E., Perrin, A., Rainie, L., & Anderson, M. (2020). 53% of Americans say the internet has been essential during the COVID-19 outbreak. Pew Research Center. <https://www.pewresearch.org/internet/2020/04/30/53-of-americans-say-the-internet-has-been-essential-during-the-covid-19-outbreak/>

Wing, J. (2016). Computational thinking, 10 years later. *Microsoft Research Blog*. <https://www.microsoft.com/en-us/research/blog/computational-thinking-10-years-later/>

.....

*Zitsi Mirakhur, Ph.D., is an assistant professor in the College of Education at the University of Kentucky and an affiliate of the Research Alliance for New York City Schools. Her research focuses on understanding ways in which we can generate more equitable school experiences and outcomes for all students, particularly students of color and those from economically disadvantaged families. She can be reached at University of Kentucky, 145C Taylor Education Building, 597 Upper Street, Lexington, KY, 40508, and by email: [zitsi.mirakhur@uky.edu](mailto:zitsi.mirakhur@uky.edu)*

*Cheri Fancsali, Ph.D., is Deputy Director of the Research Alliance for New York City Schools, where she provides leadership for strategic planning and organizational development. She advances the Research Alliance’s mission by conducting rigorous research in collaboration with the NYC Department of Education, local stakeholders, education researchers, and practitioners across the country. She can be reached at New York University, 627 Broadway, 7th floor NY NY 10012, and by email: [Cheri.Fancsali@nyu.edu](mailto:Cheri.Fancsali@nyu.edu).*

*Kathryn Hill, Ph.D., is a Research Associate at the Research Alliance for New York City Schools. She contributes to a number of projects for the Research Alliance, particularly studies examining the causes and consequences of inequality for historically marginalized NYC students. She can be reached at New York University, 627 Broadway, 7th floor NY NY 10012, and by email: [kathryn.hill@nyu.edu](mailto:kathryn.hill@nyu.edu).*