

MARCH 4, 2023

Understanding and Engaging Equity-Focused Teaching in K-12 CS Education

CSTA Equity in Action Summit

TIA C. MADKINS, PH.D.

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Thank you for joining us today!



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Session Agenda

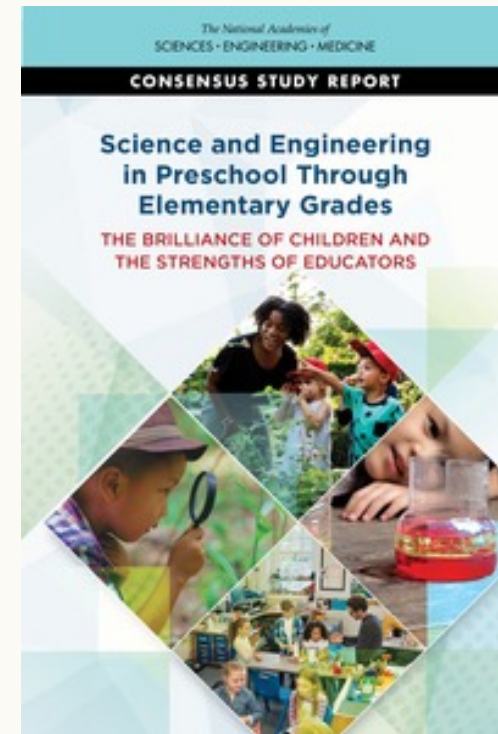
- Define equity-focused teaching in CS
- Teaching strategies to use in learning settings
- Q & A

Points of Departure

- **Minoritized** learners (not minority students)
- Contexts matter
- **Learning ≠ achievement**
 - Conceptual knowledge development, identity development, and distal measures of performance (e.g., tests, GPA, etc.)
- (In)Equity **by design**

Defining Equity

- Increasing opportunity and access
- Achievement, representation, and identification
- Expansive views of STEM + CS
- Justice
 - [Science and Engineering in Preschool Through Elementary Grades: The Brilliance of Children and the Strengths of Educators](#) (NASEM, 2022)





Join CSTA



Standard 2. Equity and Inclusion

Effective CS teachers proactively advocate for equity and inclusion in the CS classroom. They work towards an intentional, equity-focused vision to imp... t for all of their students in CS.

Indicators

Effective CS teachers:

- 2a. Examine issues of equity in CS
- 2b. Minimize threats to inclusion
- 2c. Represent diverse perspectives
- 2d. Use data for decision-making to imp...
- 2e. Use accessible instructional materia...

Equity is not just about whether classes are available, but also about how those classes are taught, which and how students are recruited, and how the classroom culture supports diverse learners and promotes retention. The result of equity is a diverse classroom of students, based on factors such as race, gender, disability, socioeconomic status, and English language proficiency, all of whom have high expectations, feel empowered to learn, and are given what they need to succeed. [adapted from *K-12 CS Framework*; see [Chapter 2](#) for more information]

Expand All Indicators



Standard 2. Equity and Inclusion

Effective CS teachers proactively advocate for equity and inclusion in the CS classroom. They work towards an intentional, equity-focused vision to improve access, engagement, and achievement for all of their students in CS.

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[Expand All Indicators](#)

Justice-Oriented Approach

- **This approach...**
 - **Asset- or strengths-based** orientations centering minoritized learners and communities

Asset-based Orientations

- **Acknowledge, confront, and reject deficit thinking**
 - Viewing learners (and families, caregivers, and communities) as deficient, in need of repair, or less competent than white (or Asian) learners
- **Prioritize asset- or strengths-based approaches**
 - **Recognize, draw, and build upon learners' strengths**
 - Find ways to **build upon learners' lived experiences** and **connect to course content**.

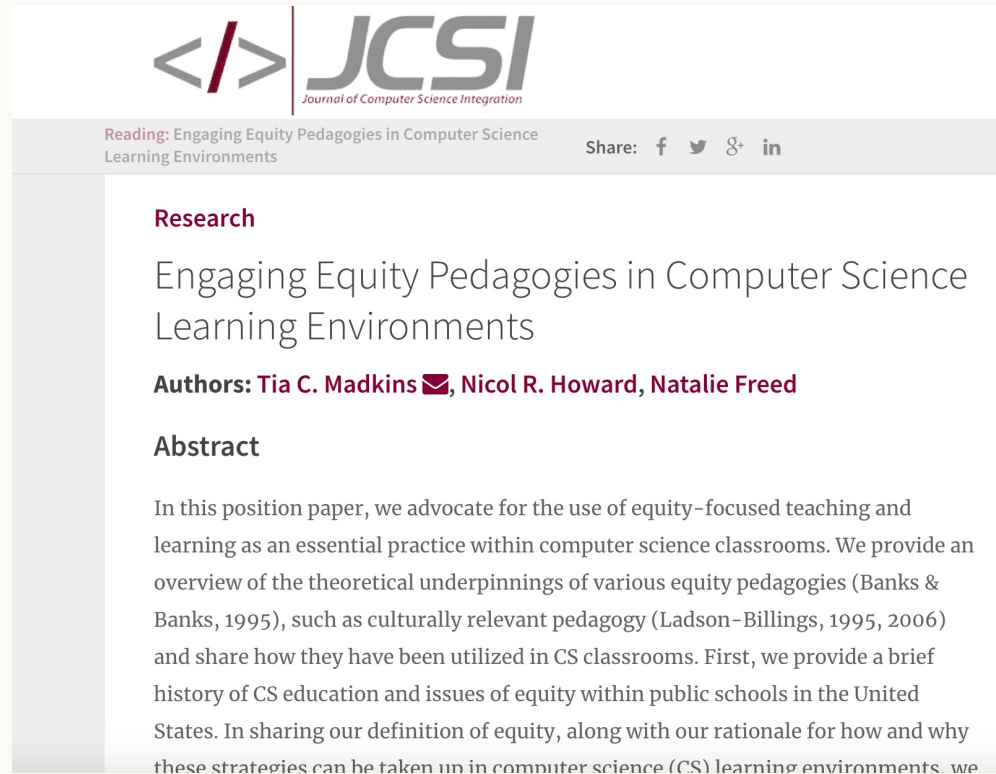
Justice-Oriented Approach

- **This approach...**
 - Asset- or strengths-based orientations centering minoritized learners and communities
 - Moves beyond access and achievement frames
 - Empowers learners to use CS knowledge for transformation

Equity-Focused Teaching

- [Culturally responsive and relevant education](#)
(Gay, 2000; Ladson-Billings, 1995)
- [Culturally sustaining pedagogy](#)
(Paris & Alim, 2014, 2017)
- [Culturally responsive computing](#)
 - (K. Scott & Sheridan, 2015)
- [Kapor Center's Culturally Responsive-Sustaining CS Education Framework](#)
 - (K. Davis et al., 2021)

Madkins, Howard, & Freed (2020)



The image is a screenshot of a webpage from the Journal of Computer Science Integration (JCSI). At the top left is the JCSI logo, which consists of a stylized code symbol '</>' followed by the text 'JCSI' and 'Journal of Computer Science Integration' below it. To the right of the logo is a navigation bar with the text 'Reading: Engaging Equity Pedagogies in Computer Science Learning Environments' and social media sharing icons for Facebook, Twitter, Google+, and LinkedIn. Below the navigation bar is the main content area. It starts with the word 'Research' in a bold, dark red font. This is followed by the title 'Engaging Equity Pedagogies in Computer Science Learning Environments' in a large, black, sans-serif font. Below the title are the authors: 'Authors: Tia C. Madkins', 'Nicol R. Howard', and 'Natalie Freed'. The word 'Abstract' is written in a bold, black font. The abstract text begins with 'In this position paper, we advocate for the use of equity-focused teaching and learning as an essential practice within computer science classrooms. We provide an overview of the theoretical underpinnings of various equity pedagogies (Banks & Banks, 1995), such as culturally relevant pedagogy (Ladson-Billings, 1995, 2006) and share how they have been utilized in CS classrooms. First, we provide a brief history of CS education and issues of equity within public schools in the United States. In sharing our definition of equity, along with our rationale for how and why these strategies can be taken up in in computer science (CS) learning environments. we

Equity-Focused Teaching: Common Practices

- Relationships
- Feeling loved, valued, and a sense of belonging
- Recognize, draw, and build upon learners' cultural practices
WITHOUT [cultural appropriation](#)
- [Critical consciousness development](#)

Why Use Equity-Focused Teaching Practices?

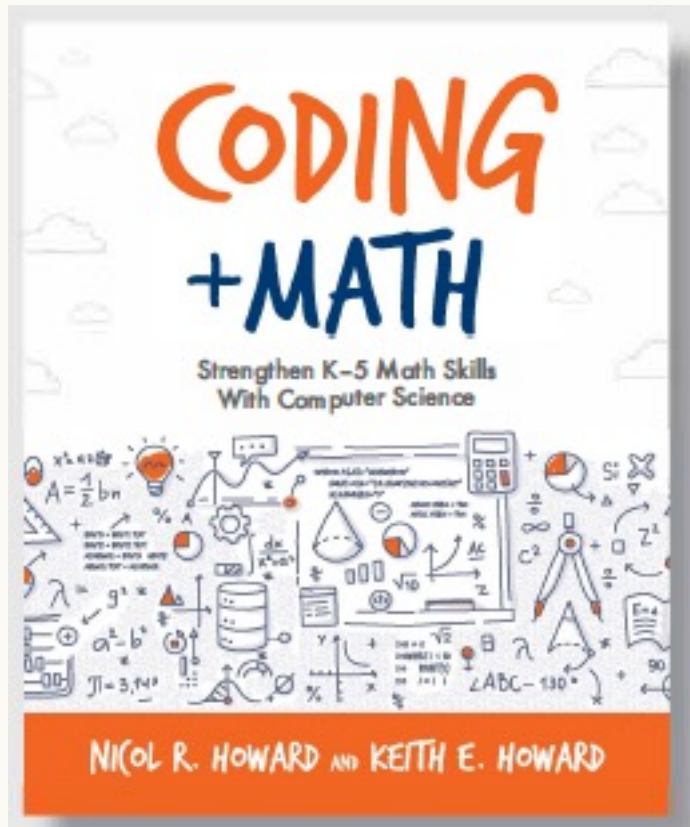
- **Strengthen learner outcomes** (e.g., interest, motivation, course enrollment, pursue CS in higher education/fields, learning, achievement)
- Empower learners to **use CS knowledge to transform their communities in ways they see fit**
- Support **identity development**
- Promote **expansive views** of CS fields, professions, and practices in multiple ways
- Allow learners to **pursue CS education alongside social justice goals**

Equity-Focused Teaching: Social Justice Issues

- Disparities in CS outcomes
- AI tools and biases
- Racial profiling & police brutality
- Digital divide

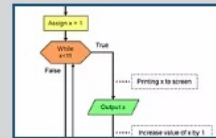


N. Howard & K. Howard (2020)



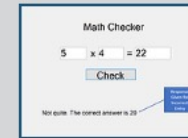
Lesson Examples

[Purchase Book](#)



[Flowchart-Based Programming](#)

Example lessons on programming based in a flowchart program. This platform is ideal for introducing younger learners to computational thinking.



[Windows Form Programming](#)

Example lessons in programming for Windows-based PC computer operating systems typically used with productivity software.



[Kids Corner](#)

Example lessons demonstrated by elementary school student Kamau, demonstrating how easy and fun real coding can be.

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Howard (2019)

 SpringerLink

Original research | Published: 16 July 2018

EdTech Leaders' Beliefs: How are K-5 Teachers Supported with the Integration of Computer Science in K-5 Classrooms?

[Nicol R. Howard](#) 

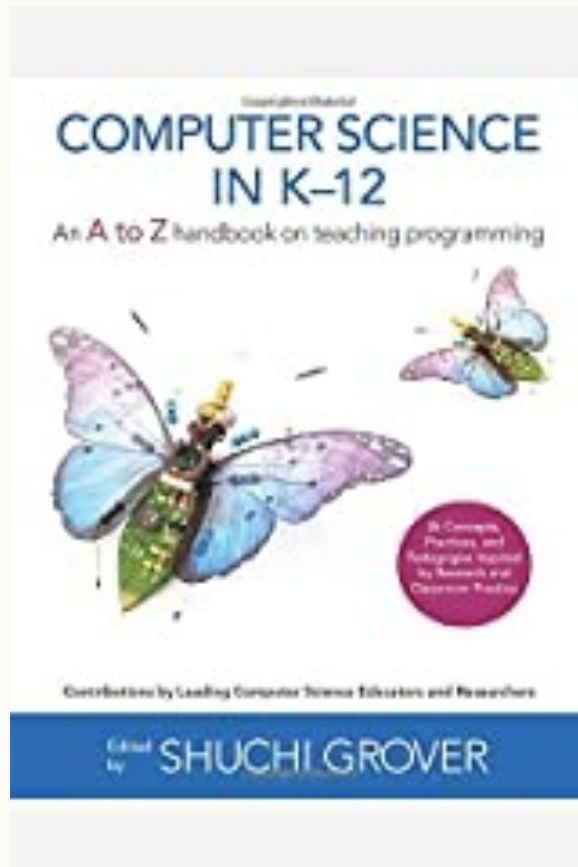
Technology, Knowledge and Learning **24**, 203–217(2019) | [Cite this article](#)

572 Accesses | 1 Citations | 8 Altmetric | [Metrics](#)

Abstract

Educational Technology Leaders' support of computer science teachers in K-5 classrooms are influenced by their beliefs about school-based program implementation criteria, available district-level support, and state mandates on the integration of computer science. The researcher in this study examines the beliefs about Computer Science teacher support, and training in five different Educational Tech Leaders' districts, to determine sustainable implementation practices for K-5 schools. In order to effectively integrate computer science in K-5 instruction, administrators and program decision-makers must be aware of the beliefs Educational Technology Leaders hold related to the implementation process of programs, specifically related to the training of K-5 teachers who facilitate the computer science curricula in classrooms. Information reported in this study may inform school-level, district-level, and state-level decisions related to sustainable computer science program implementations.

Madkins et al (2020)



er science teacher, found that using these culturally relevant educational tools to teach web-based software allowed high school students to apply lessons on algorithms, computing, and how to better use search engines to "create simulations of cultural arts, such as Native American beadwork, as [they] moved from concepts to making, students were excited to finally start 'programming' their rugs, baskets, and beadwork [...] with little direction from [the instructor] they deep dived into the website problem-solved, made mistakes, and iterated."

In their work in an introductory computer science course with Jakita Owensby Thomas found in their research that integrating cooking to expose students to algorithmic thinking as a starting retention of black women undergraduate students for that coo

Such programs suggest engaging underrepresented s experiences that strengthen their cultural, linguistic, g more equitable learning outcomes in computing.

CULTURALLY RELEVANT PEDAGOGY IN PRA

► How We Selected These Practice Exam

Next, we provide practical examples of how teachers have use sustaining practices in programming classrooms in schools, st student outcomes. We selected these examples because they e sustaining teaching practices we believe are empowering and i ming. Importantly, these examples come from our observation contexts that each aim to support students of color in making tween programming and their lives. We desired to provide ex can use as a guide to support their professional learning and g positively influence student learning goals and outcomes (e.g. gramming. These examples are sample methods educators car scriptive approaches simply to be replicated. We encourage ed es to determine what will work well for their unique schoolin; that engaging in this work can at times be challenging and me these practices into their pedagogical approach with an aim to

We organize our ideas and guidelines for CRP in programmin

- A. Connect with students' cultures/life experiences
- B. Empower students to become change agents
- C. Relationships with students, families, and communities

► Connecting With Students' Cultures/Life

Rooting computing curriculum and pedagogy in the cultural t allows them to engage and learn about programming in meani assets, life experiences, and community knowledge as the bui have found the following teaching strategies to be effective:

- Engage students with programming activities that are contextualized in students' school communities (e.g., creating the best transportation route for afterschool activities in their community as a way of learning minimal spanning trees)

Learner-Centered and Culturally Relevant Pedagogy

Tia C. Madkins, Jakita O. Thomas, Jessica Solyom, Joanna Goode, and Frieda McAlear

CHAPTER 12

INTRODUCTION: CULTURALLY RELEVANT PEDAGOGY

Underrepresented minority students (for example, black, Latinx, Native American/ Alaskan, Hawaiian / Pacific Islander in the United States) have historically experienced racial bias and structural inequities both inside and outside of school settings. Educational inequities appear at all levels, from low funding for schools with high proportions of underrepresented students of color to diminished teacher and counselor expectations, tracking students into remedial and special needs programs, and over-referring students to school disciplinary officials. For underrepresented students of color, these practices are an extension of colonial and assimilative educational practices, have led to the development of school-perpetuated (historical) trauma, and contribute to experiencing an education environment that feels irrelevant, hostile, and unwelcoming.

Culturally relevant pedagogy (CRP) was first proposed by Ladson-Billings as well as Allen and Boykin in the 1990s. CRP is founded on the idea that learning grounded in a familiar cultural context can potentially increase equitable outcomes. This framework outlines three tenets for academic success: (1) implementing academic rigor, (2) honoring students' cultural and linguistic backgrounds, and (3) helping students to understand, recognize, and critique social inequities. This mode of teaching also emphasizes an authentically caring rapport between teacher and student and connecting curriculum to students' home cultures and everyday lived experiences.

WHY CULTURALLY RELEVANT PEDAGOGICAL PRACTICES MATTERS IN COMPUTING

One emerging area of scholarship combines the well-established research and practice of culturally relevant pedagogy with programming education to develop engaging and rigorous programming instruction for underrepresented students of color. This line of research provides a conceptual foundation for integrating culturally relevant pedagogical frameworks into programming instruction across learning contexts. In programming, principles of culturally relevant pedagogy and related approaches include: (1) *supporting student identity development*, (2) *encouraging a critique of inequities in computing*, and (3) *addressing sociopolitical issues*.

For indigenous communities, this means that computing experiences involve curriculum that facilitates ongoing interaction and cooperation among key stakeholders, including tribal and community agencies,

- Make programming accessible by connecting learning to students' personal interests, social identities, perspectives, and everyday lives (e.g., inviting a student who skateboards to help introduce a culturally situated design tool about the culture and mathematics of skateboarding)
- Draw from students' cultural assets and knowledge to use as building blocks for examining programming (e.g., using programming paradigms such as loops and linked lists, or same algorithm can be represented in different ways)

students to both identify an issue of concern to their lives, and technology-based solution (e.g., mapping food deserts in urban

► Students to Become Change Agents

et al view on the impacts and ethics of programming is necessary student agency to address community problems and inequities that software development. Examples of how this can be done include thical, influences in programming that have led to bias and ms and software (e.g., face-recognition misgendering rates for

e impacts of large technology firms on diverse and historically : the impact of Twitter and other tech companies on s in urban cities like San Francisco?)

around data, privacy, surveillance, and other issues with nd civil rights (e.g., police searches of social media accounts) : collaboration skills with programming activities to help students tions to others (e.g., presenting a data science project about an r of representations or designing and gathering feedback about a issue)

e technological ecosystem to identify potential points of ication leaders, policymakers, venture capitalists, corpora rs play in shaping the programming opportunity landscape for ., creating a power map of institutions, companies, and l success of people of color in tech)

ships With Students, Families, and

students and their families is an important aspect of culturally unities can play a vital role in supporting and sustaining g education for underrepresented students of color.

What we have learned about [swimming and] computer science is that all of the seemingly cultural preferences and interests are profoundly impacted by historical legacies, structural inequities, denied learning opportunities, and belief systems that justify these inequities - Jane Margolis, *Stuck in the Shallow End*

Thank You! | Q & A



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Resources for Further Learning

- **CSTA:** [Inclusive Teaching Pedagogies](#) | [Standards for Teachers](#)
- **Raspberry Pi Foundation:** [Understanding Computing Education V. 2](#), [EDI in Computing Education](#) | [Computing Courses](#) | [PD/Research Seminars](#)
- [Computer Science Education: Perspectives on Teaching and Learning in School \(2nd ed\)](#)
- [Women in STEM Role Model Posters](#) (available in 8 languages)