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Catalyzing the Computer Science Education Community to Commit to Justice

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Abstract

This paper examines the commitment of the computer science (CS) education community to equity and justice. By analyzing 146 public pledges from 119 organizations using the Kapor Center's Culturally Responsive-Sustaining Computer Science (CR-SCS) Framework, we assess focus areas such as racism, inclusive classroom cultures, rigorous curriculum, student voice, community engagement, and diverse experts. Findings show efforts in affirming student identities and community involvement but reveal gaps in addressing racism and recruiting diverse speakers. The results highlight the need for a comprehensive approach to ensure equity and inclusivity in CS education. This study provides crucial insights into the current state of CS education and emphasizes the importance of holistic commitments to justice.

Introduction

In the past 15 years, computer science (CS) education in the United States has experienced significant growth, driven by the increasing importance of digital literacy in the modern world. The growth of CS education has been significantly influenced by policy and advocacy efforts. Organizations such as Code.org, the Computer Science Teachers Association (CSTA), and the National Science Foundation (NSF) have played crucial roles in advocating for CS education. The "CS for All" initiative, launched by the White House in 2016, marked a pivotal moment, aiming to provide every K-12 student the opportunity to learn CS. This initiative catalyzed numerous state-level policies that mandated or encouraged the inclusion of CS in school curricula (Smith, 2018).

In response to advocacy and policy changes, many states have developed or adopted CS standards. The development of the K-12 Computer Science Framework in 2016 provided a comprehensive guide for states and districts to design curricula that emphasize computational thinking, problem-solving, and the ethical implications of technology (Grover & Pea, 2018). The expansion of CS education necessitated a focus on teacher preparation. Initiatives such as the NSF-funded CS10K project aimed to train 10,000 high school CS teachers by 2016 (Yadav et al., 2016). Professional development programs, including those offered by Code.org and CSTA, have been essential in equipping teachers with the skills needed to teach CS effectively. Despite these efforts, a shortage of qualified CS teachers persists, highlighting the need for ongoing investment in teacher education (Goode, 2018).

Research on student outcomes indicates that early exposure to CS education positively impacts students' academic and career trajectories. Studies have found that students who take CS courses are more likely to pursue CS-related degrees and careers (Sax et al., 2016).

Furthermore, CS education fosters critical thinking, problem-solving skills, and creativity, which are valuable across various disciplines (Grover & Pea, 2018).

Equity in access to CS education remains a critical issue. Studies have shown disparities in CS participation based on race, gender, and socioeconomic status. For instance, Black, Latinx, and Native American students, as well as girls, are underrepresented in CS courses (Scott et al., 2017). A recent study by [Anon] (2018) on the CSforALL initiative highlights the growing involvement of diverse community stakeholders in CS education. The [Anon Organization], launched in 2016, has significantly contributed to expanding CS education through community pledges. This model of soliciting pledges from various organizations, including schools, non-profits, and for-profit companies, has been effective in driving local ownership and sustainable change in CS education. The analysis of these pledges indicates a strong focus on both formal education settings and teacher professional development, with a notable impact on students and teachers across the United States (Anon, 2018).

Despite the progress, challenges remain in ensuring comprehensive and equitable CS education as well as the need to highlight the role computing plays in harms and biases inherent in technologies. There is a need to better understand where and how the CS education community is at this point in terms of its commitment to equitable computing education that goes beyond access. Kapor Center's Culturally Responsive-Sustaining Computer Science (CR-SCS) Framework focuses on creating equitable and inclusive K-12 computer science education (Kapor Center, 2021). The framework addresses the racial, socioeconomic, and gender inequalities in K-12 CS education. It ensures that students' interests, identities, and cultures are embraced, validates their voices, and engages them in socio-political critiques of technology. This approach includes six core practices, such as understanding the role of racism in CS, creating inclusive classroom cultures, and incorporating diverse role models and community assets into the learning process.

In order to examine whether and how the CS education community is focused on equity and justice in their work, we analyzed a corpus of a public data set made to [anon organization] using the CR-SCS Framework.

Methods

Data Sources. In order to analyze the public data set, we imported the data into a google sheet including the public statements, measure, category, and focus area. The statement included a short statement that briefly described what the organization was going to focus on during the upcoming year as well as a longer version of the statement. The pledge also included how the organization would measure whether they achieved their goals. The pledging organization must also select a focus category to classify the mechanisms by which they will center their work - racial equity, raise awareness of computing, build capacity to offer CS, and/or increase equitable access and outcomes in CS. Finally, the public data set indicated organizations select the demographic group of focus (e.g. students with disabilities, women/girls, underrepresented

minority groups, rural communities, pre-service teacher preparation programs, family/community engagement).

Data Analysis. In order to analyze the public data, we conducted a descriptive analysis of the focus on the pledges. In addition, we used the components of the CR-SCS framework to examine whether the stated commitments addressed aspects of equity and justice. We used sub-components of the six main components from the CR-SCS framework (role of racism in CS, inclusive and equitable classrooms cultures, pedagogy and curriculum is rigorous, student voice and student agency, families and communities as assets, and diverse experts in classrooms) (Kapor Center, 2021). Initially, two coders collaboratively coded 10% of the data to develop a consistent coding framework. During this phase, we held regular meetings to discuss and refine the coding scheme. The same coders then independently coded another 10% of the data to establish reliability, which led to 100% agreement. After establishing reliability, the coders independently coded the remaining 80% of the data using the agreed-upon codebook.

Results

There were a total of 146 commitments from 119 organizations made during 2023. Figure 1 shows the commitments by states with California leading the total number of commitments.

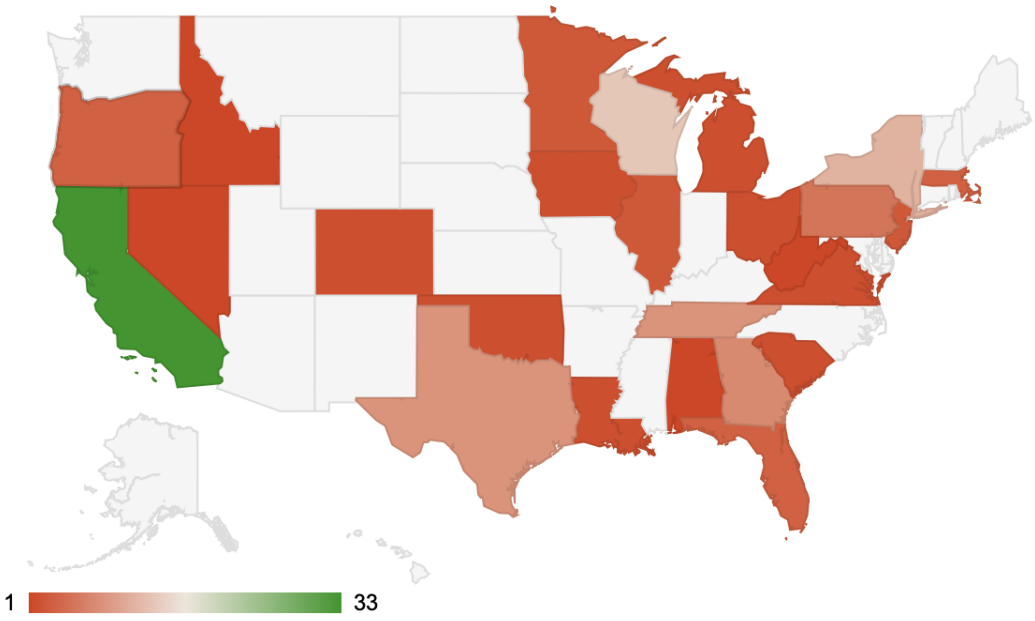

Figure 1: [Anon Organization] Commitments by State.

Role of Racism in CS				Inclusive and Equitable Classrooms Cultures					
Educator Identity	Callout Racism	Awareness Of White Supremacy	Anti-Racist Practices	Dispel Stereotypes	Educator Explore Own Identity	Affirm Students' Identity	Recruit Students (Marginalized Groups)	Explore Study Identity	Accessible Classroom Community
3	0	0	3	2	4	35	21	0	0
Total # of Commitments Mappted to Role of Racism in CS Sub-Components: 6				Total # of Commitments Mapped to Inclusive and Equitable Classrooms Cultures Sub-Components: 41					

Pedagogy and Curriculum is Rigorous				Student Voice and Student Agency			Families and Communities as Assets		
Rigorous Curriculum	Support Students' Cultures	Learn Students' Cultures	Critically Examine Technology	Value Family And Community Perspective	Partnerships With Community Organizations	Family And Community Engagement	Value Family And Community Perspective	Partnerships With Community Organizations	Family And Community Engagement
1	14	1	7	6	5	2	20	21	22
Total # of Commitments Mapped to Pedagogy and Curriculum is Rigorous Sub-Components: 23				Total # of Commitments Mapped to Student Voice and Student Agency Sub-Components: 13			Total # of Commitments Mapped to Families and Communities as Assets Sub-Components: 63		

Diverse Experts in Classrooms				
In-School And Out-Of School Experiences	Exposed To Range Of Technology Careers/Pathways	Local And National Tech Share Knowledge	Recruit Diverse Speakers (Marginalized Groups)	Variety Of Tech Tools In Classrooms
9	1	2	1	2
Total # of Commitments Mapped to Diverse Experts in Classrooms Sub-Components: 15				

Figure 2: Public Data Set Mapped to Culturally Responsive-Sustaining CS Framework

The results outline various pledges mapped to different sub-components of the Culturally Responsive-Sustaining CS Framework. Our goal was to interrogate whether these pledges catalyze efforts to create a more inclusive and equitable CS education environment. Below we present the data based on the six core practices of the framework:

Role of Racism in CS: For the sub-component of educator identity, there are 3 commitments. There were no pledges related to callout racism and awareness of white supremacy. Anti-racist practices had 3 pledges. In total, there are 6 pledges mapped to the role of racism in CS sub-components. This indicates some initial efforts to address the role of racism in CS education but highlights significant gaps in areas like explicitly calling out racism and raising awareness of white supremacy.

*Inclusive and Equitable Classroom Cultures***:** Within this category, there are 2 pledges for dispel stereotypes, 4 pledges for educators to explore their own identity, and a strong emphasis on affirming students' identity with 35 pledges. Recruit students (marginalized groups) mapped to 21 pledges. There are no pledges to explore study identity and an accessible classroom community. The total number of pledges mapped to inclusive and equitable classroom cultures sub-components was 41. This suggests some focus on affirming students' identities and recruiting marginalized groups, though efforts to create accessible classroom communities and exploring students' identities are lacking.

*Pedagogy and Curriculum is Rigorous***:** In this category, rigorous curriculum had one pledge, supporting students' cultures had 14 pledges, learning students' cultures had one pledge, and critically examining technology had 7 pledges. The total number of pledges mapped to pedagogy and curriculum rigorous sub-components was 23. This reflects a strong emphasis on supporting students' cultures and critically examining technology, aligning well with culturally responsive pedagogy.

Student Voice and Student Agency: For student voice and student agency, value family and community perspective has six pledges, Partnerships with community organizations had five commitments, and family and community engagement had 2 commitments. The total number of commitments for this category was 13. This indicates efforts to engage with families and communities, ensuring that the curriculum is relevant and inclusive.

Families and Communities as Assets: The Families and Communities as Assets category showed a strong emphasis with 20 commitments for value family and community perspective, 21 commitments for partnerships with community organizations, and 22 commitments for family and community engagement. This resulted in a total of 63 commitments, indicating robust community involvement in CS education.

Diverse Experts in Classrooms: In the Diverse Experts in Classrooms category, in-school and out-of-school experiences had nine commitments, exposed to range of technology careers/pathways has one commitment, local and national tech share knowledge has two commitments, recruit diverse speakers (marginalized groups) had 1 commitment, and variety of tech tools in classrooms had two commitments. The total number of commitments mapped to Diverse Experts in Classrooms sub-components was 15. This highlights that efforts are being made to introduce students to diverse experts and career pathways, though there is room for growth in recruiting diverse speakers and exposing students to a variety of tech tools and careers.

Scientific or scholarly significance of the study or work

Findings reveal important insights into the current state of commitments toward creating an inclusive and equitable computer science (CS) education environment. The data demonstrated that there is a certain level of commitment towards affirming students' identities, supporting inclusive classroom cultures, and involving families and communities in CS education. However, areas such as explicitly calling out racism, exploring students' identities, and recruiting diverse speakers in classrooms show a need for increased focus. As the focus of computing education moves towards justice (Yadav and Heath, 2022), it is important that the field commits to ensure a holistic approach to equity and inclusivity in computer science education.

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