From State Legislation to Implementation: Moving Towards Justice-Centered Computing

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ABSTRACT

The demand to enact state-level computer science (CS) policies rapidly increased across the United States in response to advances in emerging technologies (e.g. Artificial Intelligence, cybersecurity, etc). The authors of this paper present the implications of K-12 CS education policies in the state of Tennessee, and recommendations to move towards justice-centered approaches after districts received *Strategic CSforALL Resource & Implementation Planning Tool* (SCRIPT) workshops to help set goals and prioritize CS implementation. Evidence connected to the CS education literature accompanied by the authors, who are partners supporting local education agencies (LEAs), and qualitative findings from workshops provided further reasoning for policy recommendations.

CCS CONCEPTS

• **Social and professional topics** → **Governmental regulations**; *Race and ethnicity*; *K-12 education*.

KEYWORDS

Computer Science Education, Policy Implementation, Justice-Centered Computing Education, K-12 CS Education, Teacher Professional Development, State Policy

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1 INTRODUCTION

The state of Tennessee passed legislation in May of 2022, specifically, *Senate Bill 2406*[1], mandating computer science education (CSEd) from K-12. The legislation outlined offering CS integrated at the elementary level, a 9-week course for middle grades, and a graduation requirement with one foundational high school course [1]. The CSEd literature underscores the problematic nature of state policies, particularly instituting graduation requirements, has on fostering equitable access to CS [19]. The landscape of the geopolitical climate in Tennessee further emphasized disparities, particularly in large rural communities with limited access to technology infrastructure, certified teachers, and adequate devices to implement CS under the current state legislation. While funds are allocated in the bill as ongoing, a parallel scenario occurred during the Obama unveiling of the "Computer Science for All" initiative in 2016 [14]. The upwards of four billion dollars in funds to achieve high-quality CS implementation fell significantly short with majority being allocated to the organizations such as the National Science Foundation (NSF), and almost a decade later the CSEd community continues to define what computer science for all means [18].

We used inspiration gathered through our Research Practice Partnership (RPP), also known as *SCRIPT Crew TN*, focused on district level strategic planning in order to inform the recommendations made in this paper. In order to offer recommendations centered on equity and justice, we focused on Scott et al. pillars of Justice-Centered computing to ground our advocacy of equitable and socially responsible initiatives in Tennessee. The current policy does not account for the needs of professional development, standards, teacher recruitment, and infrastructure for intersectional identities of youth and faculty. We advocate prioritization must take into account unintended consequences which may cause further harm to youth and educators marginalized by race, socioeconomic status, gender, and ability. Scott et al. contend "technology should be a vehicle by which students reflect and demonstrate understanding of their intersectional identities" [26, p. 421] and high quality

policy should enable and empower approaches that meet this goal.

2 POLICY LANDSCAPE AND EXPERIENCES BY LEAS

After funding was awarded from the NSF for our RPP, Tennessee approved a policy requiring high schools to offer computer science. This state-level mandate caused a domino effect, and changed the original problem of practice from a need for "buy-in" to critical support for schools and districts to satisfy policy requirements. The problem of practice therefore shifted to **"School districts in the Southeastern State need support to prepare for and increase capacity to achieve equitable and high-quality CS education, which is standards-complete, inclusive, and culturally relevant."**

In the 2022-2023 school year, 7% of high school students in Tennessee took a foundational CS course [30]. While students received an increase in access to foundational courses, the participation rate, particularly for students in rural districts, and who are girls, Black, Hispanic, or have a 504 Plan or Individualized Educational Program (IEP), remained underrepresented [30].

The *SCRIPT Crew TN* team aligned efforts to address the problem of practice, and focused on capacity building needed for school districts to achieve the minimum criteria of the mandate, and identified regions of focus based on demographics and need for access to CS in order to reach the project's broadening participation in computing goals. The components of capacity the team elevated included administrative partnership within the community, ongoing supportive professional learning communities for teachers, improved infrastructure, and a plan to reinforce capacities coherent with local vision [24]. The project used structured planning activities which engaged foundational grassroots leaders to go beyond "compliance" and with the goal to achieve CS education for more girls, Black, and Hispanic students in a state lacking justice-centered pathways [25].

2.1 Prior Research

Prior work with the *Strategic CSforALL Resource & Implementation Planning Tool* (i.e. SCRIPT),indicated the rubric can be used to shift focus of school leaders from buy-in to questions of quality in implementation [2]. The SCRIPT workshops also generated useful data for state leaders about the type of capacity building needs from school districts, and how policy makers and policy implementation designers can best resource schools to achieve policy goals. [24] Prior research addressing systems change utilizing a district-level tool to create a vision and rubric for priority setting called out the lack of equitable and often rigorous outcomes using this top-down approach [6, 10].

In other states, policies such as this significantly impacted smaller or rural school districts with limited access to teacher professional development, broadband internet, and curricular materials [29]. Teachers often reported sentiments of being pulled in multiple directions and prioritizing a new initiative such as CS fell short[4]. Additionally, access to funding and coursework to scale CS using Exploring Computer Science (ECS) curriculum proved challenging in other states with large rural populations[23].

2.2 Data Insights and Recommendations

As a result of the project, thirteen districts in Tennessee received SCRIPT workshops aligned to the rubric addressing items such as 1. Materials and Curriculum, 2. Leadership, 3. Teacher Capacity and Development, 4. Partners, 5. Community, and 6. Technology Infrastructure [31]. According to the National Center for Education Statistics (NCES), the districts' demographics indicated classifications as rural-distant, with the largest district serving 12,378 students[5]. A recent analysis on initial 3-month goals set by each district during these workshops indicated a priority on teacher professional development, establishing local partnerships, communicating the implementation of CS to families, and development partnerships with area schools and educational institutions [5]. While the districts are early in the enactment of their strategic planning and roll out, goals set and qualitative findings indicated capacity building in recruitment and retention of trained CS educators, a need for broadband internet, and access to identity inclusive CS materials to prevent further marginalization of the students in these districts [5, 28].

CodeCrew, the local practice partners supporting LEAs, curated field notes during visioning and goal-setting activities at each workshop [8, 11]. The field notes were key data insights to align with Scott et al. [25] nine pillars of justice-centered computing education. In particular, CodeCrew's notes highlighted inequities in small rural districts in the area of technology infrastructure (e.g. home broadband internet access, decisions made on device management and maintenance, software support, networks and security, etc.), quality teacher professional development (PD) and certification, and funding to implement and sustain CS. Table 1 emphasized recommendations by CodeCrew aligned to Scott et al. framework exemplified by qualitative responses from LEA survey responses to improve outcomes in CSEd implementation in rural districts.

A critical lens to understand the policy landscape in Tennessee is while the recent State of CS report [30] paints a picture of an overall increase in access to foundational high school courses, participation data of students who are historically marginalized by race, gender, ethnicity, and ability status continues to be difficult to capture. The National Academies of Science Engineering and Medicine [21, 26] developed indicators of equity to measure progress towards systemic change in positive outcomes by socioeconomic, race, ethnicity, gender, and

Table 1: Justice-Centered Alignment to Participant Insights During Strategic Planning

Strategic Planning Area of Support	Participant Vignette	Recommendation	Justice-Centered Pillar
Teacher Capacity	"The endorsement course will not be available again until Summer 2024."	Scale ongoing efforts in teacher PD, certification to reach all students [17, 29].	Pedagogy & Training
Partners	"By the end of the first year, confirm corporate sponsors. Engage with industry partnerships to develop strategies for fundraising opportunities."	Develop partnerships with local CSEd organizations to support grassroots efforts and invest in technology infrastructure [16].	Coalition-Building Funding
Technology Infrastructure	"We need devices and have low connectivity. Even devices without wifi."	The current state bill does not account for infrastructure support. To increase access, participation, and capacity, the fiscal responsibility of the state is to provide "adequate and future proof" technologies [22].	Policy Agenda

Table 2: Equity Indicators, Community View LEA1

Equity Indicator	Examples from LEA Sources	Rubric Rating
Curricular Breadth	Pedagogy centered around project-learning in Career Technical Education (CTE) and CS coursework developed by the state (district website)	Developing
Access to Effective Teaching	A strategic plan was developed accounting for funding for technology access, resources, teacher PD, CS implementation, and assessment.	Developing
Access to Rigorous Coursework (CS)	1,1181 students potentially impacted [15])	Medium Impact

Table 3: Limitations of State Legislation & Justice-Centered Policy Recommendations

Current State Legislation	Justice-Centered Policy Recommendations
Subject to available funding, provide, at no charge to educators, a professional development program in computer science education for educators that includes professional learning modules that provide educators with the opportunity to learn and demonstrate competency in computer science by earning a micro-credential[7].	Ethics competencies involving race, justice, and responsibility to the community as it relates to emerging technologies should be included as a major feature of the micro-credential [28]. The state should fund ongoing teacher PD that develops connections to the community[17] and promotes justice-centered computing.
Create a computer science education network that may be integrated into the science, technology, engineering, and mathematics (STEM) school designation and regional hubs[1].	The state should utilize LEA-based delegates to communicate with CS teachers, schools, and district leaders to determine the unique needs to inform funding allocations for sustainable implementation CS courses across grade bands.
No statements addressing digital infrastructure.	

ability status. We therefore connected three equity indicators: 1) Curriculum breadth 2) Access to effective teaching and 3) Access to rigorous coursework to develop a deeper understanding how school districts who received SCRIPT workshops are emerging, developing, or highly developed in the aforementioned areas. An assessment of equitable access to CS at each grade band for a sample rural school district is provided in Table 2 and Figure 1.

The field notes and district access data analysis indicated a strong recommendation to ratify state legislation

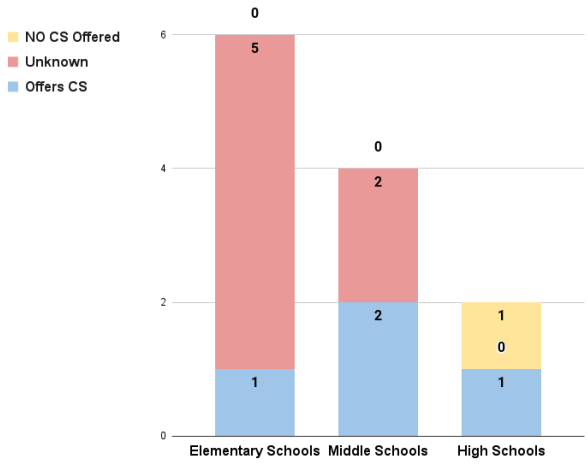

Figure 1: Access to CS Instruction

to provide justice-centered computing at scale. The current legislation offers professional development "subject to available funding"[7], and does not address inequities in broadband internet access. While LEAs express interest to increase CS course offerings, the lack of certified and skilled educators remains a challenge. We recommend ratification to the state legislation based on current policy limitations and to advocate for justice-centered computing as shown in Table 3 [17, 25].

2.3 Conclusion

The call to action we make requires the Tennessee legislator to focus CS implementation strategies which increase access to quality teacher PD, provide resources to underfunded schools (e.g. devices, materials, and broadband internet), and create a network of LEA delegates representative of the communities critically underrepresented [32]. Our recommendations to combat these disparities include advocacy for lawmakers to consider partnerships with grassroots organizations, such as the local practice partners, to develop a vision and strategic plan aligned to dismantling systemic inequities of students who are historically marginalized [25].

3 IMPLICATIONS

While CodeCrew is uniquely positioned to promote justice-centered computing as a result of local partnerships in rural school districts, lessons learned during SCRIPT workshops present implications on the greater CSEd community. A study conducted on the impact of the Covid-19 pandemic on CS education illuminated the growing digital divide [20]. State-level mandates increase this divide by not accounting for access to in-home broadband internet, ongoing funding for refreshing devices, software and material needs, and security infrastructure. Further implications on scalability and sustainability for in-service teacher PD is critical to retain, recruit, and incentivizes CS educators [16]. Most importantly, the need for continued advocacy using a multi-stakeholder approach with grassroots leadership to source funding to advance justice and equity must be prioritized [25]. Together as researchers and practice partners, we recognize the current political tensions in the state of Tennessee and other similar climates and stand firmly to represent the educators, students, and families who continue to be underrepresented by advocating for the integration of justice-centered strategic planning, pedagogy, and practice regardless of the policy environment.

4 POSITIONALITY STATEMENT

We approach this work as a Research Practice Partnership (RPP) with the goal of educational change to advance equitable practice [12, 13]. As such, building trust, open communication, and creating boundaries (e.g. material creation, data collection, and roles with school districts) are structural tenets of the RPP to disclose our position as a partnership [3, 9].The RPP is composed of two African American women, two White women, and one African American male. Our diverse professional backgrounds include K-12 general and CS education, higher education, non-profit, and industry. We endeavor to deliver equitable insights on how quality, justice-centered CSEd could be provided to all youth. The practice-partners represent a CS nonprofit focused on empowering socially, culturally and economically diverse youth [27], and local education agencies through CS education. The nonprofit also contributes to workforce development through a dedicated department that trains young adults who are underrepresented in technology to be software developers. Moreover, the organization actively advocates for statewide computer science education legislation, resulting in the ratification of a bill requiring CSEd across a Southeastern state. The researchers represent a national CS membership organization with a collective 16 years of K-12 teaching, advocacy, and research experience. Inspired by our combined interest in supporting socially, culturally, and economically diverse students, teachers, school districts and influencing CS policy, our experience and advocacy work uniquely position us to provide insights into CSEd policy. We acknowledge our collective positions of power and privilege which allowed us to operate with reflexivity and empathy.

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