Situating Equity in Education Policy to Advance Broadening Participation in Computing (BPC)

Megean Garvin, Ph.D.
Maryland Center for Computing Education
University System of Maryland
Adelphi, MD, USA
mgarvin@usmd.edu

Sarah T. Dunton, M.Ed.
ECEP Alliance/MGHPCC
Holyoke, MA, USA
sdunton@mghpcc.org

Katelin Trautmann
College of Education
University of Texas at Austin
Austin, TX, USA
katelin.trautmann@utexas.edu

Joshua Childs, Ph.D.
College of Education
University of Texas at Austin
Austin, TX, USA
joshuachilds@austin.utexas.edu

Carol Fletcher, Ph.D.
Texas Advanced Computing Center
University of Texas at Austin
Austin, TX, USA
cfletcher@tacc.utexas.edu

ABSTRACT

State computing education policy advocates utilize legal language to build systemic change for broadening participation in computing (BPC) efforts. This study posits that state education policymaking, involving law and regulations that influence the norms and practices in K-12 classrooms, requires identifying authority structures and systems, which are accountable for delivering equitable computing education. Of the 29 states and Puerto Rico in the Expanding Computing Education Pathways (ECEP) Alliance, 14 states have computing education laws, and 9 states have mandated reports. Recommendations for how states can refine existing policies or create new equity centered state computing education policies are provided.

This study was funded and supported by the National Science Foundation #2137834.

CCS CONCEPTS

Social and professional topics → Professional topics → Computing education → K-12 education

KEYWORDS

equity, state policy, broadening participation in computing, systemic change, K-12 education

RESPECT 2024, May 16–17, 2024, Atlanta, GA, USA

ACM 979-8-4007-0626-4/24/05.
https://doi.org/10.1145/3653666.3656101

ACM Reference format:
Megean Garvin, Sarah T. Dunton, Katelin Trautmann, Joshua Childs, and Carol Fletcher. 2024. Situating Equity in Education Policy to Advance Broadening Participation in Computing (BPC). In *Proceedings of the 2024 RESPECT Annual Conference (RESPECT 2024), May 16--17, 2024, Atlanta, GA, USA.* ACM, New York, NY, USA, 9 pages. https://doi.org/10.1145/3653666.3656101

1 INTRODUCTION

Computer Science (CS) instruction in American K-12 education is not a new or novel idea. In 1956, CS instruction was introduced in Buffalo, New York to Hutchinson Central Technical High School seniors who intended to become engineering majors in college [1]. The high school seniors and instructor built a computer and electromagnetic relay machine which operated on a binary number system. Later in 1958, middle school students in China, California were selected for coding in Speedco [2]. Harley Tillitt envisioned an American workforce of varying abilities needing to learn coding.

> "At the present time, programming is being done throughout the country both by individuals who have college degrees and those who do not. It is reasonable to expect that future demands for programmers will require large numbers of both types. The success of the students in these experiments shows that it is feasible to introduce computer programming instruction below the college level [2]."

It took longer for CS instruction to enter the elementary level of instruction. In 1970, academically talented fifth and sixth grade students from twelve Florida schools were taught by Pensacola Junior College instructors on a variety of topics including history of computers, numeration systems, hardware, and FORTRAN programming [3]. Despite these examples representing groundbreaking CS K-12 instruction, the CS course offerings were not available for all, as students were selected based on their

mathematical and scientific abilities. It has been over 60 years since Tillitt's initial call for more CS instruction, and despite national efforts and President Obama's CS for All initiative in 2016, equitable access to CS has yet to be achieved. Even as more states have diligently addressed broadening participation in computing (BPC) issues to achieve CS equity, policymakers and policymaking have continued to lag when it comes to increasing CS opportunities for minoritized students. This has led to disparities in technology use and engagement for student groups based on race, class, gender, and socioeconomic status [4].

CS education (CSEd) policy at the state level should address two things: 1) authorizing (and supporting) the delivery of high-quality CS teaching & learning experiences for students, and 2) creating a structure of accountability that schools (and districts) must meet to ensure that students are equitably accessing CSEd. This should also include providing guidance on how much decision-making autonomy occurs within each level of a state's educational system [5]. Policy language can dictate whether schools or states focus on "checking the box" within a written report or instead prioritizing equitable opportunity, implementation, and student learning outcomes in CS when policy is translated into practice.

In 2017, a consortium of CSEd organizations led by Education Development Center (EDC) and MassCan published the first State of the States CS Landscape Report [6], which outlined ten priorities for promoting K-12 CSEd. This report highlighted the need for targeted CSEd policy, beyond the implementation of exploratory CS curriculum, as a way to scale, sustain, and advance CSEd strategically. That report also highlighted the importance of embedding equity within CSEd policy discussions. Despite the number of states creating reports on their CS landscape, it remains difficult to identify state policies that explicitly name and support diversity, equity, and inclusion initiatives or address the underlying root causes of inequities in CSEd. If the BPC efforts, as well as CS for All efforts, hope to weather the current political tensions around diversity, equity, and inclusion (DEI) language, then the policies and advocacy efforts supported must drive towards the use of language that explicitly identifies actions and strategies which drive equitable outcomes in CSEd and focus on systemic reforms that address the root causes of inequity.

1.1 Prior and Related Work

Recent state advocacy efforts began within individual states and later states coordinated their efforts to network and learn across state policy contexts as part of the ECEP Alliance, funded by the National Science Foundation (NSF). From 2006 through 2012, Georgia Computes!, which was also funded by NSF, engaged in BPC work to promote computing with female, Black, and Hispanic students in Georgia [7]. At the same time, the Commonwealth Alliance for Information Technology Education (CAITE), also an NSF BPC project, was leading efforts to expand computing and information technology education across Massachusetts. In 2012, these successful projects later merged as ECEP and worked across Massachusetts, Georgia, California, and South Carolina. Today, there are 30 advocacy teams from 29 states and the territory of Puerto Rico that have joined ECEP. Each team works with stakeholders to identify policies that will work within their state to further BPC efforts. The teams network monthly to share strategies, goals, data, successes, and challenges [8]. The ECEP Alliance, working as a collective impact alliance, has provided the time and space for teams to learn from each other as they continue their state BPC efforts. BPC efforts have grown to examine the needs of student subgroups via disaggregated data based on race and ethnicity, gender, socioeconomic status, geographic locations, and accessibility [9,10].

Another key component of this work is for advocates and researchers to confront their own biases and continue the lifelong learning process of understanding how they are situated in and can influence changes in computing education ecosystems. To address biases and expand ECEP's ability to help state teams address inequities across CSEd, a team from ECEP participated in the Cultural Competence in Computing (3C) fellowship, a project led by the AIICE Includes Alliance. Through this work, the team determined that more tools are needed for ECEP state teams to successfully advocate for CSEd in their states. The 3C fellows engaged in intense professional development (PD), moving through the six stages of cultural competence from cultural destructiveness through cultural proficiency [11]. The fellows work towards a deliverable to support BPC efforts. The fellows relied upon their experiences and materials from the fellowship and identified state team member attrition in the state advocacy space as an issue which occurs frequently. The team is dedicated to creating onboarding BPC tools and resources. By breaking down the types of policies into laws, regulations, and norms and practices, state teams are able to target which policies need to be drafted or revised and how the state team can work within the state policy infrastructure to more effectively advance their BPC goals.

1.2 Types of CS Education Policies

In the United States, the states govern education laws and determine what will be taught and required in the public schools. Typically, state education **laws** are drafted, edited, and passed by the state legislature and then either signed, vetoed, or passed without a signature from the state's governor. This is a lengthy process that is heavily debated, and terms are carefully selected or modified through this process. ECEP states have enacted CSEd laws for numerous purposes, such as requiring all high schools to offer CS courses or setting licensure for CS teachers.

Regulations are often drafted by government agencies to clarify and guide how to further follow the laws that are in place which give authority to an entity to carry out and/or monitor compliance with the law. For education regulations, the State Department of Education, also referred to as the State Education Agency (SEA), the State Superintendent or Chief, or the State Board of Education

are examples of entities who typically set the regulations. These regulations are often opened to public input and/or comment prior to adoption. State teams need to understand how, if at all, advocates can share data, and provide public comments before regulations are adopted and enacted. High school graduation requirements and state standards are typically addressed through regulation rather than law.

Norms and practices are more difficult to pinpoint, but they are equally as important to determine which conditions are supporting or impeding BPC policy work. These are often cultural influences of how and why decisions are made within the education ecosystem without specific policy that spells out the decision-making processes. These can include competing priorities, instructional time allocated to other content disciplines, process and authority for resource allocation, and awareness of the importance of BPC. After thoroughly reviewing the state laws and regulations, state advocates need to have conversations with stakeholders to understand the norms and practices within each level of the state's education governance. Teachers, administrators, and policymakers will have varying perspectives of how and why norms and practices are established and reinforced with the organizational system structures. Norms and practices can influence the translation of policy to practice and lead to unintended consequences for even well-intentioned policies.

1.3 Complex Policy Language

Legal English language is primarily based in Latin, but it has evolved over the last fifty years. Judges, policymakers, lawyers, and legal analysts are well-versed in this legal language and communicate effectively when drafting, passing, and later interpreting laws and regulations. In 1978, President Carter's executive order required government agencies to provide "clear and simple language" for the public, and this began a push and pull between utilizing legal or plain language in legal documents [12, 13, 14]. For education law, there is another layer of education language that is woven into the legal documents as well. For example, the National Commission on Excellence in Education released their report, *A Nation at Risk: The Imperative for Educational Reform* in 1983 [15]. Immediately following its release, the term *at risk* began to be used in education legal documents. This term was problematic and left open to multiple interpretations by states. Multiple interpretations of *at risk* also filter down to variations at the local school system level. For example, the Arizona State Department of Education was able to insert its authority and power to identify which school systems were ranked as *at risk* [16]. In fact, these rankings masked the historically marginalized and perpetually underserved schools and surrounding communities in which they were situated [16]. Just as the term *at risk* moved into the legal education language, there are consequences to using terms that hold multiple meanings in different contexts. Definitions and clarifications need to be embedded into these documents whenever possible.

The quilted matrix of legal, education, and plain languages creates a complex process to draft and pass state CSEd policy which minimizes multiple interpretations and at the same time maximizes the impact and reach to the goal of BPC. ECEP state CSEd advocates are well-versed in two of the three of these languages and are often able to assist policymakers in understanding how particular terms or phrases are interpreted and used in education contexts. Being aware of the potential for stakeholders who are advocating for, or drafting policy together to perceive terms differently is the key to creating policies that support BPC and avoiding unintended consequences created when policies are written that do not account for a common voice and community input.

2 EXTENDING THE CAPE FRAMEWORK

The CAPE Framework gave state teams the language and structure to begin to assess equity across multiple levels of a state computing education ecosystem [17]. The four key components of this framework includes: Capacity for, Access to, Participation in, and Experience of equitable CS education [17].

Now, states need to explicitly include the armor of policy found beneath the cape. State law should include language which specifies the student subpopulations who are currently being marginalized and not receiving CSEd instruction. Policy has the potential to address who has authority to hold schools accountable for delivering CS instruction to K-12 students as well as how much decision-making autonomy occurs within each governing level from the state down to the classroom.

Well-crafted policies should include both requirements related to CSEd and accountability or measurement structures. This ensures policies are enacted at every level of the system with fidelity. The language used in state CSEd policies is critical to how policies are interpreted and implemented at each level in the state. Such accountability helps states and schools go beyond shallow approaches to CSEd policy by checklist and promotes a more thorough examination of how CS instruction is implemented, and which students are experiencing success in CS courses. To that end, this study seeks to answer the following research questions:

1.) What, if any, equity policy language is used in ECEP Alliance state policies?
2.) How, if at all, have CSEd state policies impacted the systemic structures in ECEP Alliance states?
3.) How, if at all, have ECEP Alliance states included accountability in state policies?

3 METHODS

The data was collected via the ECEP Alliance states which completed a shared document with prompts to provide state laws, regulations, and norms and practices. State teams worked through the document and left questions as comments when they needed

further clarification. State teams also met with the ECEP Alliance team members individually in online meetings to answer any lingering questions. When state teams referred to any particular state law or regulation, the documentation was gathered as documents and placed in each state's online folder. The research team reviewed all of these documents to better understand the state policies in each state.

This qualitative data was analyzed by using the interpretive grounded theory method with a constant comparative approach [18, 19]. Internal validity addressed the accuracy of the data by incorporating member checks and participant involvement during the data gathering and initial coding process [20]. The data analysis involved three primary stages (open coding, axial coding, and selective coding) for this study [18]. The open coding stage was completed by the state team participants who interpreted the state law, regulations, and norms and practices prompts to complete the initial state policy form provided by the research team. Next, the research team performed the axial coding in which data was gathered across all ECEP Alliance states to make sense of the language used in the different types of policies. Finally, selective coding connected the core categories and findings.

4 POSTIONALITY STATEMENT

The research team is dedicated to understanding CSEd policy and consists of five members. There are three 3C Fellows, two are ECEP state team leaders, two are ECEP Alliance Co-PIs, and a graduate student. Our research team has one black male, one black female, and three white women. We recognize that our ages, political beliefs, social classes, races, ethnicities, genders, religious beliefs, previous careers, and current roles in our organizations and as ECEP Alliance members influenced this study [21]. We believe that this work is complicated and that those who are closest to the state-level policy work provide the most accurate narrative. Two researchers maintain an insider's perspective for the states in which they work and an outsider perspective for the other states. The other three researchers have outsider perspectives to the state teams. We worked closely with each state team to collect, interpret, and analyze the data for the primary open coding phase of this study. We recognize that this study presents the most accurate and current data provided in a given time frame and that policy continues to evolve from this time until the time of publication and dissemination of this study. We intend to continue to follow the progress of each ECEP Alliance state.

5 RESULTS

The ECEP Alliance states each have state-level teams of professionals who are dedicated to BPC efforts within their given states. The policy landscape in each state varies as does the efforts to change state laws and regulations; however, the ECEP Alliance enables these states to learn from each other as they each progress towards equity in computing education. Three significant themes emerged which provide the states with a lens to understand their current policy landscape and a means to create state strategic CSEd plans to make further policy changes. These themes include the language used in policy, the systemic structures, and which authority retains the governance to hold schools accountable for BPC.

5.1 Equity Policy Language

Some ECEP states have chosen to require all students to take CS courses. A total of 15 ECEP states require the public high schools to offer CS, 18 ECEP states have CS as a graduation requirement, and 13 ECEP states have CS as satisfying part of the higher education admission requirements. For example, Arkansas law states, "Beginning with the entering ninth grade class of 2022-2023, a high school student shall be required to earn one (1) unit of computer science credit before the student graduates [22]." While these policies are promising steps toward equity, the implementation at the school level continues to show disparities. Courses might be offered but not all the students have access to take the courses. Teacher shortages, school scheduling conflicts, and limited school resources are some of the numerous barriers to implementing CS at the school level [23]. The students who have been marginalized historically are too often the same students who are not able to access the CS courses within their school.

Controversy as to which policy language is used in which state persists. Some states, such as Texas and California, have banned the use of any student subgroup identification terms within the scope of affirmative action policies [24] and have considered banning terms such as equity as well [25]. In order to truly understand the inequities, state policies should include specific language for which student subpopulations are marginalized and not receiving CS instruction and name the norms and practices that will address the needs of all students. Maryland included the legal language for particular subgroups, "increase the enrollment in middle and high school computer science courses of: I female students; II students with disabilities, and III students of ethnic, racial, and other demographic groups that are underrepresented in the field of computer science as identified by the U.S. Equal Employment Opportunity Commission" within their specific computing education policy passed in 2018 [26]. This makes sure that all other student groups not explicitly stated in the policy can be added without a lengthy amendment process. Nevada also specified subgroups within the legal language: "Make efforts to increase the enrollment in the course of female pupils, pupils with disabilities, and pupils who belong to ethnic and racial groups that are underrepresented in the field of computer science, as identified by regulation of the State Board [27]." However, Nevada provides the authority to the State Board to regulate and include additional student subgroups as needed.

Equity is a term that some states use extensively within their policy documents while others have banned it for fear of the interpretation of its intended meaning, or political backlash [28]. Regardless of the use of this specific term or others that might be

controversial in some state policy contexts, the overall BPC and CS for All goals to provide CS instruction to all American public students in all public schools remains unchanged. State CSEd advocates need to investigate and understand which state education laws already exist, how they might be modified to include CS, and when to work with policymakers to draft or amend state education laws to move the state toward equity.

5.2 Systemic Structures

State education policy contexts reinforce systems that have been in place for a long time. These systems span from the state to the school system to the school and classroom. The state guidance provided on what is taught, who can teach, and how the content discipline is supported are critical in understanding if and when CS instruction occurs and who has access to the courses.

CS Content Standards provide the structure for what is taught. There are 21 ECEP states which have CS standards. These standards are like the content standards in place for other content disciplines, such as mathematics and science. For example, on May 3, 2018, the Hawaii State Board of Education Student Achievement Committee (SAC) approved the adoption of the K-12 Computer Science Teachers Association (CSTA) Standards [29]. This provided the school systems and schools with a set of standards to follow when selecting CS courses and curricula. Illinois took a different approach and mandated in their state, "students entering ninth grade in the 2022-23 school year and each school year thereafter must participate in one year of a course that includes intensive instruction in computer literacy, which may be English, social studies, or any other subject and which may be counted toward the fulfillment of other graduation requirements [30]." This means that schools have more flexibility into interpreting how computing is implemented. This flexibility alleviates the issue of establishing the infrastructure and resources needed for CS courses, but it becomes more problematic to monitor if and when each student received the full year of computer literacy. Also, computer literacy can be interpreted in numerous ways, and the implementation might not align with the rigor suggested but not specified in the state law.

Next, who teaches CS has been a limiting factor for many schools to offer and hold CS classes. Each state determines the levels and types of credentials for all their teachers. Traditionally, teachers required a deep knowledge and skills of the subject matter before becoming a teacher in a content discipline. For example, a biology teacher often obtains a biology bachelor's degree and then takes pedagogy courses as part of the pathway to becoming a biology teacher. Who teaches CS has been addressed by 20 ECEP States which have certification guidance in place. Virginia followed the traditional pathway and teachers can either earn a CS degree or a degree with up to 36 semester hours in particular areas [31]. Obtaining a CS degree and then becoming a teacher rather than going into a more lucrative job in industry is not a realistic choice for most graduates. Therefore, recruiting teachers from the CS graduates typically only results in a few CS teachers. Ohio temporarily allowed "an individual holding a valid educator license in any grades 7-12 to teach a computer science course if, prior to teaching the course, the individual completes a PD program approved by the district superintendent or school principal that provides content knowledge specific to the course the individual will teach [32]." This enabled the state to train teachers and offer more CS courses in their schools. Alabama took a different approach and provided several ways for teachers to earn their credentials. In 2019, the State Superintendent enabled current teachers to take Praxis 5652 Computer Science to add the CS certification and also provided adjunct instructor permissions for industry experts to teach CS courses [33].

In addition to teachers who are currently licensed to add credentials to be able to teach CS, 15 ECEP states are working with higher education to provide opportunities for preservice teachers to learn CS. It is critical for the next generation of teachers regardless of which level or subjects they prefer to teach, have CS knowledge and skills and states are working to determine how to credential teachers to teach CS without having to obtain a CS degree.

Unfortunately, with innovative pathways to credential CS teachers, there can be issues and challenges that disrupt the usual systemic processes. In Connecticut, there was a misinterpretation that a CS course could count as a mathematics credit only if it was taught by a certified math teacher. To combat this practice throughout the state, the Connecticut State Department of Education created a policy document to further clarify and change this practice to include all certified teachers who were eligible to teach CS in the state [34]. This is an example where a practice was occurring and impeding who could teach the CS courses in this state. To change this practice the State Department of Education intervened and clarified that any certified teacher could teach the CS course, and students can earn the mathematics credit.

Finally, funding is needed to change systemic structures and promote BPC. There are 18 ECEP states which have dedicated state funding to assist this work. State funding has been used to convene task forces, write and adopt CS state standards, hire CS state specialists, recruit CS teachers, provide PD for in-service teachers, create or enhance preservice teacher programs or courses, and hold strategic meetings at the state and local levels to implement and support CS instruction. Funding models vary across states with some states receiving one-time funds while others provide ongoing annual funds.

CS state systemic changes take time, resources, and funding for BPC to move forward. ECEP state teams have worked diligently to improve their state systems. Each is at varying levels of success and the alliance enables them to work with and learn from each other as they continue to implement and sustain these changes.

5.3 Authority and Accountability

Each state retains the authority to govern public education with decision making processes and authority. Some states take a top-down approach with more decisions occurring at the state level often with a State Superintendent or Chief overseeing the SEA and working with a State Board of Education while other states defer many public education decisions and governance to local boards of education and Superintendents of Local Education Agencies (LEAs) requiring a more of a grassroots approach to reform policy locally [35]. Unpacking the nuances within each state to determine where laws and regulations are enacted and enforced is critical for each state advocacy team to understand which reforms are needed and at which level these reforms need to occur.

The state education policy ecosystems contain levels of governance with embedded language or norms and practices for who has authority to hold schools accountable for BPC. As mentioned previously 21 ECEP states have CS standards in place, but simply having them in place does not provide the full understanding of how these standards were created or who enforces that they are followed. For example, Maryland is a local control state in which the majority of decisions are made at the LEA level, and this means that the Maryland CS K-12 Standards that were adopted by the Maryland State Board of Education in 2018 are voluntarily followed by the LEAs and implementation is decided at this level [5]. Rhode Island's CS standards were also adopted in 2018. The state assembled a group which customized the CS state standards and specifically included this statement, "We worked to ensure equity is embedded in the standards themselves, the descriptions, and the accompanying suggested activities [36]." This state team centered equity in their document. LEAs in Rhode Island are encouraged but not mandated to follow the standards.

This then leads state teams to advocate for CS infrastructure within the SEA, so there is someone with CS content knowledge and skills at the state level. There are 19 ECEP states which have a designated CS specialist at the state level. The variation of authority for this position ranges from someone who offers advice and guidance to someone who approves CS courses or pathways and is based on the laws and regulations set in the state. Again, understanding how much authority this position is given helps the state team to know if there is a point of contact who has autonomy and budget to offer CS PD to teachers in the state or if this person decides on which grants are funded to which LEAs to support local PD. Each model provides training for teachers, but the authority and processes are different.

States can opt to require by law reports to monitor changes towards BPC efforts. Only 9 ECEP states have language within their state law requiring some type of report. California and Iowa had legislation that required a workgroup to report back findings on CSEd. Alabama, Georgia, Hawaii, Maryland, Mississippi, and Utah require annual reports on the progress of CSEd as specified in each of their state laws. Washington included legal language requiring each LEA to report CS specific data beyond the data that is already reported to the state to the office of the superintendent of public instruction, and the office of the superintendent of public instruction must annually post the data on its website [36]. The specific data includes:

> "1) The total number of computer science courses offered in each school and whether these courses are advanced placement classes; (2) The number and percentage of students who enrolled in a computer science program, disaggregated by: (a) Gender; (b) Race and ethnicity; (c) Special education status; (d) English language learner status; (e) Eligibility for the free and reduced-price lunch program; and (f) Grade level; and (3) The number of computer science instructors at each school, disaggregated by: (a) Certification, if applicable; (b) Gender; and (c) Highest academic degree [37]."

Collecting state data to monitor progress towards BPC has been problematic since each state handles data and reports it differently. The ECEP Alliance has worked with cohorts of states to better understand data gathering and reporting to build toward common metrics across states [38]. Data dashboards have been publicly released in 15 ECEP states. The dashboards attempt to provide data transparency as much as possible. Maryland found that stakeholders need additional support including specific definitions to better understand the data displayed in the dashboard particularly since the data tends to elicit more questions which need to be further investigated by a mixed methods approach beyond the data displayed [39]. CS state policy data must be utilized with an understanding that it can only display part of the story, and the state CS advocacy team needs to provide the additional context for the full state BPC policy narrative.

6 DISCUSSION

The 29 ECEP Alliance states and Puerto Rico have each taken steps to identify and understand their CSEd state policies. The CS state advocacy teams identified and collected documents for the state laws, regulations, and norms and practices. Equity policy language is explicitly stated in some states and absent in other states. Some states clearly define student subgroups which have been historically marginalized in CS while others imply that the policy is for all students. Disparities persist between student subgroups in all states and blanket policies, policies that are too broad to create common language, have not been effective to date.

6.1 Conclusions

Public education in America is varied by governance at the state level. The ECEP Alliance provides the space and networking needed for advocacy teams to learn and grow. This study provided a guided structure for the ECEP state teams to collect and

categorize their current state policies. Across the 29 states and Puerto Rico, the variation of the types of policies (laws, regulations, and norms and practices) as well as what is contained in these policies were unique to each state. Some states center equity language in their state laws and regulations while other states have banned the use of equity terms or listing of any student subgroups in policies. Yet, all the ECEP states have committed to the CS for All initiative. If possible, advocacy teams should work to include equity language in their policies. If the political climate is not possible to include equity language, advocacy teams need to think carefully of how to word the policies while ensuring that the intent toward equity is clear within their norms and practices. Additionally, policies must be carefully written to minimize multiple interpretations which can lead to implementation issues and unintended consequences in which the policies do not positively impact the BPC efforts.

Systemic structures organize public education within each state. The variation between the levels of education governance from the state down to the classroom within each state complicates advocacy efforts until the team has been able to trace through the decision-making processes. Identifying the CSEd infrastructure that is present or needed in each level is required for each team to unpack their policy context.

The state policies address what CS is taught, who can teach CS, and how CS is or is not seen as a distinct content discipline with infrastructure and funding. States have pursued these policies through state laws, regulations, and/or norms and practices. Each state policy context is unique with variations within each level in the CS state ecosystem. Identifying who or which office or level has the authority to create and enforce policies is a first step. Only 9 states required any type of report. Data is critical in understanding and monitoring progress toward BPC. Drawing direct comparisons between states through state data alone is currently irresponsible as the full context is needed to better understand the state's governance structure, systemic structures within each level of the state, and the state data systems and definitions. The CSEd research community is moving towards common metrics within the ECEP Alliance states, and eventually, there might be more comprehensive ways to compare state CSEd data. For now, the ECEP state advocacy teams provide the most up-to-date and full narrative including data and context of what is happening as their states move toward equity in CSEd.

6.2 Limitations and Assumptions

The limitations to this study included the data collection process, the maturity of the state teams, and the generalizability of the findings. Each state team took time to collect and interpret the data initially. Some state teams needed more time to fully understand what was being asked of them and how to interpret the differences between state law, regulations, and norms and practices. The research team assisted during the first phase of data collection by answering questions within the shared documents, via email, and during state online team meetings. This process was time consuming for all the participants and we recognize that team fatigue may have limited the amount of data collected. Some states were new to this work and had very little to share, and thus, this also limited the amount of data that they were able to collect for this study. Another limitation with grounded theory is generalizability of the findings [18]. This is a necessary tradeoff for the rich analysis that is closely tied to the phenomena in this case the state policies and policy contexts that was studied rather than a generalizable study that can be applicable to numerous other settings.

6.3 Future Research

One of the strengths of the ECEP Alliance for the last decade has been the networking and regular ongoing discussions between state CSEd advocates. As the ECEP Alliance has grown and varying levels of progress has been made within states, the need to formalize more of these processes and create shared resources has led to this current policy study and numerous other initiatives. Next steps are to provide a policy brief with targeted recommendations on how to work within individual state education policy contexts to embed equity and provide the guidance that the state CSEd advocates need to successfully implement CS for All.

6.4 Implications for Policy and Practice

The ECEP Alliance in combination with the skills and knowledge gained through the 3C fellowship has led our team to carefully examine the state CSEd policies. Extending the CAPE framework to include directly targeted state policies (laws, regulations, and norms and practices) will empower the ECEP state advocacy teams to make more powerful BPC efforts in each state. The ECEP Alliance 5-Stage Model for State Change supports a reciprocal relationship between policy and research. From the development of broad-based state teams to the incorporation and utilization of data, ECEP state teams are well positioned to interpret policy and advocate for CSEd policy reform that is anchored by decades of research. Next, teams onboard new members to confront their own individual and group biases to fully comprehend the historical and current computing education context. Then, ECEP state teams will begin to identify which types of policies govern or provide guidance on the CAPE identified and assessed inequities in the computing education policies. This will empower the state teams to expand their team to include stakeholders who can collaborate to reform or draft CSEd policies to maintain momentum towards BPC until CS for All has been achieved.

Beyond the ECEP Alliance states, other states and governance structures in other countries also benefit from this research. Policies are meant to evolve and continue to be updated. Taking the steps to first identify the current policies and then work with

stakeholders and decision makers to make the necessary policy changes with the appropriate policy language is needed in each state or country to move towards equity in CSEd. The resources that are produced from this study and the full project informs other state or country advocacy teams which are not formal alliance members but are also leveraging CSEd policies will be able to increase policy awareness and inform strategic plans to situate equity in education policy to advance BPC.

ACKNOWLEDGMENTS

We are thankful for the countless local, state, and national leaders in CSEd who contribute to the work of broadening participation in computing, but who also need to remain nameless to protect their jobs, allowing them to continue to educate our most vulnerable students. This work is not easy work, it is exploratory, and at times personal and raw. What is research for one group is the lived reality of another. Broadening participation in computing efforts, with a focus on structural change and policy, are driving us to question the status quo and name the systems that are holding back too many diverse voices. We would also like to thank the National Science Foundation (#2137834) for supporting and funding portions of this work.

REFERENCES

[1] Aaron Buchman, 1956. Computer programming and coding at the high school level. In *Proceedings of the 1956 11th ACM national meeting*, 118-121.

[2] Harley Tillitt, 1958. Computer Programming for Young Students. *Journal of the ACM (JACM)*, *5*(4), 309-318.

[3] Lister Horn and Gary Gleason, 1970. Teaching a unit on the computer to academically talented elementary school children. *The Arithmetic Teacher*, *17*(3), 216-219.

[4] Jane Margolis, Rachel Estrella, Joanna Goode, Jennifer Jellison-Holme, and Kimberly Nao, 2008. *Stuck in the shallow end: Education, race, and computing*. Cambridge, MA: MIT Press.

[5] Megean Garvin, Michael Neary, and Marie Desjardins, 2019. State case study of computing education governance. *ACM Transactions on Computing Education (TOCE)* 19.4, 1-21.

[6] Jim Stanton, Lynn Goldsmith, W. Richard Adrion, Sarah Dunton, Katie Hendrickson, Alan Peterfreund, Pat Yongpradit, Rebecca Zarch, R., and Jennifer Zinth, (2017. State of the states landscape report: State-Level policies supporting equitable K–12 computer science education. Available: https://www.ecs.org/wp-content/uploads/MassCAN-Full-Report-v10.pdf.

[7] Mark Guzdial, Barbara Ericson, Tom Mcklin, and Shelly Engelman, 2014. Georgia computes! An intervention in a US state, with formal and informal education in a policy context. *ACM Transactions on Computing Education (TOCE)*, *14*(2), 1-29.

[8] Ann Ottenbreit-Leftwich, Sarah Dunton, Carol Fletcher, Joshua Childs, ... and Victoria Abramenka, 2022. How to change a state: Broadening participation in K-12 computer science education. *Policy Futures in Education*, 14782103221123363.

[9] Sheryl Burgstahler and Richard Ladner, 2007. Increasing the participation of people with disabilities in computing fields. *Computer*, *40*(5), 94-97.

[10] Rebecca Zarch, Sarah Dunton, Joshua Childs, and Ann Leftwich, 2020. Through the looking glass: Computer science education and the unintended consequences of broadening participation policy efforts. In *2020 research on equity and sustained participation in engineering, computing, and technology (RESPECT)* (Vol. 1, pp. 1-4). IEEE.

[11] 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.

[12] Veda Charrow and Jo ann Cranall, 1978. Legal Language: What is It and What Can We Do About It? In *Paper Presented at the New Wave Conference of the American Dialect Society*, 1–27. Retrieved from https://files.eric.ed.gov/fulltext/ED169758.pdf.

[13] Christopher Williams, 2004. Legal English and plain language: An introduction. *ESP Across Cultures*, *1*(1), 111-124.

[14] Christopher Williams, 2011. Legal English and Plain language: an update. *ESP Across Cultures*, *8*, 139-151.

[15] David Gardner, 1983. A Nation At Risk: The Imperative For Educational Reform. An Open Letter to the American People. A Report to the Nation and the Secretary of Education.

[16] Margaret Placier, 1993. The semantics of state policy making: The case of "at risk". *Educational Evaluation and Policy Analysis*, *15*(4), 380-395.

[17] Carol Fletcher and Jayce Warner, 2021. CAPE: A framework for assessing equity throughout the computer science education ecosystem. Communications of the ACM, 64(2), 23-25.

[18] Juliet Corbin and Anselm Strauss, 2008. *Qualitative research: Techniques and procedures for developing grounded theory* 3.

[19] Sebastian, Kailah, 2019. Distinguishing between the strains grounded theory: Classical, interpretive and constructivist. *Journal for Social Though,t* 3(1), 1-9.

[20] John Creswell and Cheryl N. Poth, 2016. *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

[21] Andrew Gary Darwin Holmes, 2020. Researcher positionality--A consideration of its influence and place in qualitative research--A new researcher guide. *Shanlax International Journal of Education* 8.4, 1-10.

[22] Arkansas Code R. § 017

[23] Miranda Parker, 2023. Barriers and supports to offering computer science in high schools: A case study of structures and agents. *ACM Transactions on Computing Education* 23.2, 1-27.

[24] Pamela Bennett and Amy Lutz, 2022. Bans and signals: Racial and ethnic differences in applications to elite public colleges in states with and without affirmative action. *Harvard Educational Review* 92.3, 361-390.

[25] Robert McGee, 2023. Are diversity, equity and inclusion (DEI) policies unconstitutional? A ChatGPT study." *A ChatGPT Study*. https://www.researchgate.net/profile/Robert-Mcgee-5/publication/371981679_Are_Diversity_Equity_and_Inclusion_DEI_Policies_Unconstitutional_A_ChatGPT_Study/links/64a0654595bbbe0c6e06dc01/Are-Diversity-Equity-and-Inclusion-DEI-Policies-Unconstitutional-A-ChatGPT-Study.pdf.

[26] Maryland Code, Education, § 4-111.4

[27] Nevada Revised Statute, § 389.077

[28] David Embrick, J. Scott Carter, Cameron Lippard, and Bhoomi Thakore, 2020. Capitalism, racism, and Trumpism: Whitelash and the politics of oppression. *Fast Capitalism*, *17*(1), 203-224.

[29] Christina Kishimoto, 2018. Committee action on computer science standards. Retrieved from https://drive.google.com/file/d/1tMW8kJ8xAeiZT2VCKppwVE156wwJkcFW/view.

[30] Illinois Public Act 101-0654

[31] Virginia Administrative Code 8VAC20-23-300

[32] Ohio Revised Code, § 610.10

[33] Eric Mackey, 2019. Memorandum: Computer Science Certificate Approaches. State of Alabama, Department of Education.

[34] Connecticut State Department of Education. (2021). Computer science course reporting guidance. Retrieved from https://portal.ct.gov/-/media/SDE/Computer-Science/course-code-guide-final.pdf.

[35] Megean Garvin, Katie A. Hendrickson, Sarah T. Dunton, Jennifer Zinth, and Lynn T. Goldsmith, 2021. Teacher-focused policies to broaden participation in K-12 Computer Science Education in the United States. In *Preparing Pre-Service Teachers to Teach Computer Science: Models, Practices, and Policies*, 231-255.

[36] Carol M. Giuriceo, 2018. Rhode Island K-12 Computer Science Standards. Rhode Island Department of Education.
[37] Revised Code of Washington, 28A.300.587
[38] Sarah Dunton, Rebecca Zarch, Jeffrey Xavier, Jayce Warner, and Alan Peterfreund, 2022. Determining metrics for broadening participation in computing: Connecting data to multi-state computer science education policy efforts. *Policy Futures in Education*.
[39] Megean Garvin and Joshua Childs, In Press. State case study: From computing education policy to data transparency and accountability. *Education Policy*.