A Field Catalyst Approach to Systems Change in K-12 CS Education

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ABSTRACT

The computer science education (CSEd) community demands researchers, curriculum developers, schools of education, and districts take action to meet the needs of all students. This experience report from the CSforALL Broadening Participation in Computing Alliance (BPC-A) describes a Field Catalyst approach to systems change at scale. We further describe how the alliance will catalyze the field toward action supporting girls and Black and Hispanic students. By strengthening a shared identity, establishing standards of practice, disseminating a knowledge base, supporting leadership and grassroots efforts and offering frameworks to support policy for equity, the field will catalyze efforts to implement state policies for CSEd.

CCS CONCEPTS

• **General and reference** → **Computing standards, RFCs and guidelines**; • **Social and professional topics** → **Computer science education**.

KEYWORDS

Field Catalyst, Standards of Practice, Shared Identity, Grassroots Leadership, Systems Change

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1 INTRODUCTION

Education is inherently local and, especially to a student or family, the sum total of an educational pathway is made up of multiple institutions and experiences over time. Research has shown that it is a collection of both in-school and informal learning experiences, spread over time, that curate interest in computing and STEM careers [31]. Also, technology access is still unequally distributed as evidenced by data collected during the COVID-19 pandemic [20]. With these inequities disproportionately impacting the identities of youth aligned with our broadening participation in computing (BPC) populations of focus (e.g. girls, Black students, and Hispanic students), we situate this work in progress experience report on institutions directly connected to these student groups as a unit of change.

Schools and community-based organizations providing out of school time learning, are resourced by the CSforALL national network of curriculum providers and informed by practices studied by researchers and guided by standards of practice derived from the field. Although many organizations include a focus on youth whose identities align with named BPC populations in their mission and goals, or even focus on specific geographic areas with concentrations of Black or Hispanic students, few organizations are led or staffed by experts in all the necessary areas to achieve BPC outcomes. We power those capacity-building efforts through strategic planning [11, 12], community learning [4, 5], and annual prompts to move the work forward through commitments [10].

2 CATALYZING MEMBERS TO BPC THROUGH MECHANISMS

The CSforALL Alliance is the next evolution for CSforALL (previously CSNYC) to provide a central hub of CSEd resources, while supporting the grassroots efforts of organizations. Our members represent a broad cross section of the ecosystem committed to BPC. The members who directly serve students (e.g., schools, districts, informal education programs), all have a clear role to play in BPC outcomes. **To isolate focus on them, however, is to disregard the larger system each of those actors rely on in order to deliver CS instruction and create learning environments [17]**.The National Science Foundation (NSF) recognized the importance of evidence-based curriculum development through significant investments in research to develop and study curriculum and professional development [9]. Yet, research funded curricula are not the most widely adopted in the U.S. Nonprofit and for profit organizations hold a majority of the classroom implementation in K-12, and while some providers partner with researchers, much of what teachers use for CS classes is not directly connected to a research project. At the end of 2023, 456 members of the CSforALL Alliance self-identified as a "curriculum provider";119 of those members were engaged with the alliance in 2022 or 2023

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and were classified as active. Of the active curriculum providers, 81 registered at least one curriculum in our portal. Only 15 (19%) of those registered curricula were funded by NSF, and therefore were explicitly connected to BPC goals through their funding mechanism. This leaves a critical need for a connection between the evidence base being constructed through research, the goals of broadening participation set forth by NSF and the community, and the landscape of implementing organizations that produce content and materials being used in classrooms across the US and the world.

Although curricular materials and professional development are key drivers of what is taught, policy and funding are important for "if" CS is taught [23, 26]. Both CSEd specific frameworks (e.g., the CAPE framework, [14, 21], and education specific frameworks (e.g., the Coherence Framework, [16]) highlight the importance of accountability from policy and alignment [8] that include funding in order to achieve educational outcomes. Similarly, the **Field Catalyst** framework highlights the importance of policy and funding mechanisms being aligned with emerging patterns in grassroots efforts for field innovation, change, and sustainability [3].

The CSforALL Alliance is the only alliance that connects leadership and grassroots organizations who are implementing CS education with teachers and students, with the curricular landscape, research, policy makers, and funders to catalyze change. We operationalize mechanisms as programmatic engagements that support member types such as webinars highlighting the work of members, social media campaigns, organizational national convening, and pledges focused on broadening participation.

2.1 Initial BPC Impact Data

Impacts on Participants and Professionals. CSforALL activates members and contributors to the CSEd ecosystems through a variety of mechanism. During our 2023 national convening, known as the **CSforALL Summit**, the theme *Strengthening the CSEd Movement Through Equity"* sought to highlight the memberships' impact on equity . There were 370 individual attendees at the event, and 243 attendees were connected to 131 total organizations who were members of our organization. In the post survey 95.59% of respondents (N=62) reported making networking connections during the convening, and 69% of respondents indicated attending the event generated new opportunities or projects. One participant wrote *"Hearing from so many change-makers all around was so inspiring"*. **Addressing Longstanding Underrepresentation of Youth.** Although the alliance did not yet launch a meaningful programmatic shift to an explicit focus on BPC until the national convening, many members of the community focused either on Racial Equity (5 pledges potentially impacting 1,500 students) or to Increase Equitable Access and Outcomes (74 pledges potentially impacting 2,274,152 students). **Directly and**

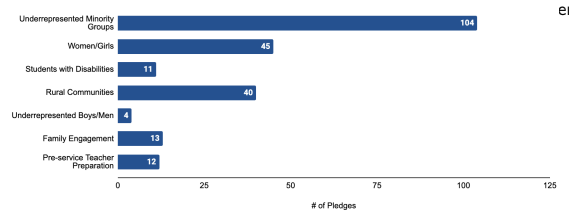

Figure 1: Pledge Focus Areas 2023

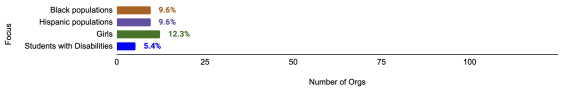

Figure 2: Percentage of Pledges by BPC Aligned Focus

Indirectly Impacted K-20 Students. Beneath the pledge categories above, pledge makers were able to select a focus area for the population impacted by their pledge to CS education. Figure 1 1 shows the 2023 focus areas as well as the direct and indirect number of students potentially impacted by the pledge intent. In addition to the numbers shown in the Figure, our organization also partnered with *CSisElementary* for 288 elementary schools pledges to provide at least 20 hours of CS instruction to 100% of students in their school. These pledges have the potential to directly impact 180,275 students from 35 states. **BPC Alliance Strategies and Alignment to Impact.** In the first year of implementation, the data and membership team analyzed the pledges made in 2023 by active members for a baseline of BPC focus. Data show only a minimal focus on outcomes for youth whose identities align with BPC populations (see Figure 2 2) from the 73 active member organizations who were involved in a pledge. The low percentages of focus on youth whose identities align with BPC populations provide strong evidence for the need of field level focus on BPC to achieve systems level change.

2.2 Defining the Field to Catalyze Change

The design of the alliance is grounded in evidence-based practices from existing BPC Alliances such as NCWIT and ECEP [1], as well as principles of a field catalyst [3]. Additionally, we use the literature of implementation sciences to inform our approaches focused on distributed systems changes and apply research studying systemic change where new practices emerge in order to achieve BPC outcomes and quality improvements in CSEd [13, 22]. We identified the need to activate members around actions, goals, and a common agenda to work collaboratively toward equitable CSEd for all students, situating our organization as a strong field: [18].

- **Shared Identity**:As a membership including a variety of CSEd actors, including researchers, we engage members with similar motivations, goals, and

agendas to reduce barriers and systemic marginalization for youth whose identities align with BPC focal populations, particularly girls, Black, and Hispanic students.

- **Standards of Practice**:We partner with other national organizations and alliances focused on the implementation of high-quality CSEd such as the Computer Science Teacher Association (CSTA), AiiCE Alliance, AccessCS Alliance, NCWIT to codify practices and support practitioners and students for culturally-responsive sustaining outcomes. Standards of practice are already offered in rubric form for school districts or other Local Education Agencies (LEAs).
- **Knowledge Base**: We offer mechanisms (e.g. technology infrastructure, resources, cohorts, the convening, etc.) with the intent to drive active members to engage in these mechanisms and form cross-partner relationships to broaden participation in computing for girls, Black, and Hispanic students. Acknowledging the existence and intersectionality of racism, ableism, classism, gender, and ethnic inequalities are critical to reducing systematic marginalization [24, 27, 29]. Currently, the knowledge base available includes white papers which are written to resource a variety of members in the field.
- **Leadership and Grassroots Supports**: We use frameworks and guided strategic planning in its programmatic offerings to create local ownership of CSEd initiatives [7], create opportunities for school leaders to engage in culturally responsive school leadership practices [19], and create coherence in implementation strategies [6].
- **Funding and Supporting Policy**: In recent a white paper, [25] authors found a significant gap between the intention of state policy and its implementation at the school and district level. We build on the Policy to Practice recommendations to close the support gap at the local level and continue to work with national networks such as ECEP, NCWIT, the Computer Science Teachers Association and others intentionally for BPC in the design and execution of CSEd pathways for students.

To achieve systems change and support grassroots efforts for sustainable innovation resulting in BPC objectives, we engage in the four integrated roles of the field catalyst intermediary [3]:

- **Understand the Field and Engage the System:**Leveraging mechanisms such as partnership brokerings, focus groups, attending BPC focused convenings, we engage in systems measurements as a national resource to understand the interests, trends, and patterns of members within the alliance.
- **Strengthen Capacity of Local Community Initiatives:** We develop mechanisms, including cohorts/working groups, standards of practice, and a shared knowledge base by engaging members.
- **Make the Work of Local Initiatives more Visible, Coherent, and Robust:** The impact of our BPC Alliance is contingent upon a multi-stakeholder partnership (MSP) approach [28]. The MSPs (or members, partners, and evaluators), together with our organization distribute a shared knowledge base of CSEd standards of practice, exemplary BPC aligned resources/curriculum materials, and landscape visible data for the field.
- **Nudge Systems to Catalyze Systems Change:** We disseminate findings from activities, interventions, and partnerships as a result of the three previous indicators with the larger national network. We seek to inspire activated members to identify new areas of BPC systems change in the field.

3 POSITIONALITY STATEMENT

We approach this work as a national membership organization focused on catalyzing systems change to advance equitable practice [18]. As three White women, we acknowledge the privilege with which we are positioned in the field of broadening participation and use our privilege to learn how to interrogate systemic barriers of oppression within the CS education community [2]. Our professional backgrounds include K-12 general, STEM, CS, higher education, and non-profit work. Our cumulative impact of almost six decades in K-12 teaching, advocacy, and research experience collectively drives our passion.

4 LIMITATIONS AND ASSUMPTIONS

A limitation shared in this work in progress considers the shift in member-focused activities grounded by the strong field framework. As a new alliance engaging with members and initiating a call to action from researcher and content provider members, we acknowledge the need to iterate on operationalizing how to codify standards of practice, calling-in the knowledge base, and building a shared identity in CS education.

5 IMPLICATIONS AND NEXT STEPS

We explicitly support the development of ecosystems that provide standards-complete pathways for 100% of students and opportunities for interest-driven deep learning for students who wish to explore CS in more depth. The data show that it is not individual groups alone who form small and discrete pockets of critical under-representation, but instead a sweeping problem across almost every community and possible under-resourced, under-served, or under-estimated population. As we continue to engage members in evidence-based and evidence-guided BPC activities, implications and next steps are anchored by four field catalyst activities:

- **Create a Shared Field Identity:** We also need to curate carefully and continuously a sense of field identity. By curating a shared identity we are able to motivate and activate members to share important information, data, or resources to help us *Understand the Field and Engage the System*. Creating a sense of shared identity requires member attention and will need the development of resources and new member activities at community events. A key metric of success for field identity is members will not only believe in the importance of student access to CSEd, but will set a goal of equitable participation for all students, especially students with identities aligned to BPC focal populations, in inclusive and quality classroom environments. These experiences will encompass both the general literacy needed for all students to succeed in the digital age, but also foster key STEM and computing career pathways.
- **Develop and Operationalize Standards of Practice:** The multifaceted nature of alliance members is why we are applying a field approach, as opposed to collective impact where a more uniform approach is expected. This also means there cannot be a single shared standard of practice for the field, as the way a school district implements quality for BPC will be different from the way a funder measures quality for BPC outcomes. *We will develop and operationalize 4 field-informed and member type connected standards of practice.* The membership will be engaged through working groups to inform the initial development of the standards of practice.
- **Make BPC Data Visible:** Data is a key mechanism of both alignment (ie. creating shared goals) and accountability [8, 15, 26]. Although the annual State of CS Report does create a view of the access students have to CSEd [30], the data no longer contains student participation numbers and does not track student pathways over time. Therefore, we will *build Visible and Interactive BPC Data* dashboards. The data will include the standards of practice self assessments, available national data sets from both CSEd and education databases more generally, other programmatic data, curriculum alignment data, and additional data as it becomes available or relevant. CSforALL seeks to measure the actions taken by members in the alliance to inform best practices in the field.
- **Funding and Supportive Policy Environment to Nudge the System:**We will track shifts in the funding and policy landscape and engage members focused on funding and policy-making in partnership with other organizations. Funders and policy makers will receive annual calls to action aligned with the national convening and community events.

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