

Building State Capacity for Leadership in K–12 Computer Science Education: A National Summit

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Evaluation
and Research
Report

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1. Introduction

The Building State Capacity for Leadership in K–12 Computer Science Education Summit (the Summit) was held in Cambridge, Massachusetts, on April 3 and 4, 2017. The goal was to address the need for states to take a more strategic and systemic approach to computer science (CS) education,¹ as a way to guard against systemic problems overwhelming or stalling local programmatic efforts to promote CS education for all students. The Summit brought together multi-sector teams from 10 states that had demonstrated leadership and developed strategic approaches to effect statewide impact on K–12 CS education. During the two-day event, the 10 teams shared best practices, addressed common challenges, and worked on action plans to build their capacity for continued leadership.

The Summit provided a rare opportunity for state teams to bring together stakeholders from education, business, government, and beyond for two days of focused work. Table 1 shows the team compositions of Summit registrants in terms of sector representation by state. This report is based on information gathered at the Summit and on follow-up research conducted in the spring and summer of 2017.

Table 1: Composition of Summit Team Participants

Sector	AR	AZ	CA	MA	MD	NV	TX	UT	VA	WA
Business	2	2	2	2	1		1	1		4
Government	4	2	4	3	1	5	3	6	3	3
• Education	2	2	3	2	1	4	3	2	3	2
• Executive	2		1			1		2		1
• Legislative				1				1		
• Workforce								1		
Higher education	2	2	1	2	2	1	1	1	2	
K–12 education	2	1		4	1	4	1	3	2	2
• Administrator	1			2	1	4	1	3	1	2
• Teacher	1	1		2					1	
External advocates		2	4	1	3		1	1	2	3
Total team size	10	9	11	12	8	10	7	12	9	12

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The Summit was organized around four “pillars”—key areas critical for crafting and sustaining statewide strategies relating to K–12 CS education:

- Engaging business and industry
- Developing statewide leadership coalitions
- Ensuring that the work is grounded in equity
- Engaging government leadership

Work on each pillar began with a plenary session that identified areas of progress and remaining challenges; this was followed by state-based working sessions, facilitated by Summit staff. Meals and break times provided opportunities for participants to interact with members of other state teams.

Participants were asked to complete a short online evaluation at the end of the Summit. In addition, during the summer and fall of 2017, we conducted follow-up interviews with key leaders of each state’s team to learn about their ongoing efforts on behalf of statewide CS education and the ways in which the Summit had supported these efforts.

2. Survey Findings

The Summit survey was administered at the end of the Summit, and 50 members from state teams completed the instrument (a response rate of 50%). To ensure honest and forthright responses, we did not ask survey respondents to provide identifying information.

The first set of questions asked about the four pillars of the conference, with the same set of questions for each pillar. Respondents indicated the extent of their agreement with each statement, using a four-point scale. Overall, there was high agreement to each item in all categories (see Table 2).

Table 2: Agreement on How We're Doing

	Agree	Enthusiastically Agree	Total Positive (Agree + Enthusiastically Agree)
Engaging Business and Industry			
Our state is well along.	47%	21%	68%
I learned a lot from this panel.	60%	35%	95%
We developed actionable items.	74%	24%	98%
Developing Statewide Leadership Coalitions			
Our state is well along.	57%	28%	85%
I learned a lot from this panel.	61%	33%	94%
We developed actionable items.	64%	34%	98%
Ensuring that the Work is Grounded in Equity			
Our state is well along.	44%	20%	64%
I learned a lot from this panel.	44%	53%	97%
We developed actionable items.	58%	33%	91%
Engaging Government Leadership			
Our state is well along.	54%	22%	76%
I learned a lot from this panel.	49%	36%	85%
We developed actionable items.	62%	28%	90%

In general, respondents didn't think their states were as far along on equity and business engagement as they were on building their state coalitions and engaging government leadership. Teams' consistently highest responses were about developing actionable items for all four pillars, suggesting that this was a significant outcome of the meeting.

To answer each statement, respondents were offered a four-point scale of agreement: "I don't agree at all" (1), "I don't agree" (2), "I agree" (3), and "I enthusiastically agree" (4). The graphs in Figures 1–4 depict a weighted average for each question or item: if a respondent indicated "I enthusiastically agree" to a statement, that response was given the value of 4; if another respondent selected "I don't agree at all" the item received a score of 1. And the weighted average of those two responses would be 2.5 (that is, $[4+1] \div 2$). The weighted average for each item was calculated by taking the mean of all 50 responses to the item. For example, in Figure 1, the average weighted response to the statement *Our state is well along* is 2.89, which is between "I don't agree" and "I agree," although much closer to "I agree" (3.0).

When looking at a set of graphs depicting weighted scores to these questions, we see that the responses to the three questions across categories are roughly the same.

Figures 1–4: Weighted Responses to Four Categories

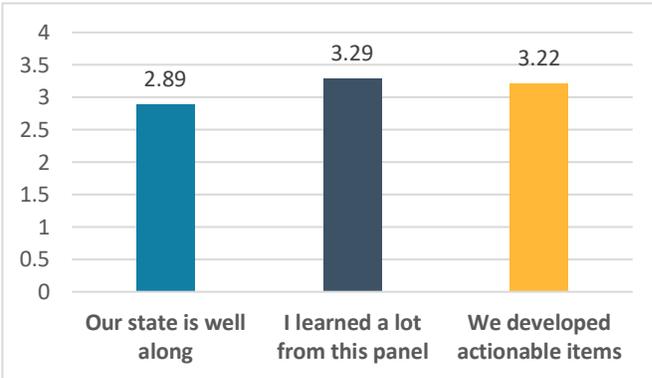


Figure 1: Engaging Business and Industry

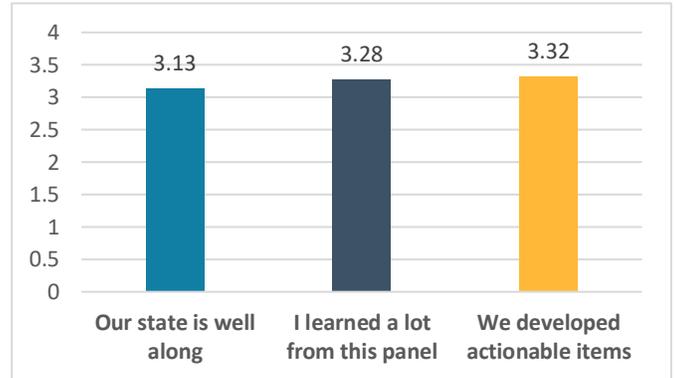


Figure 2: Developing Statewide Leadership Coalitions

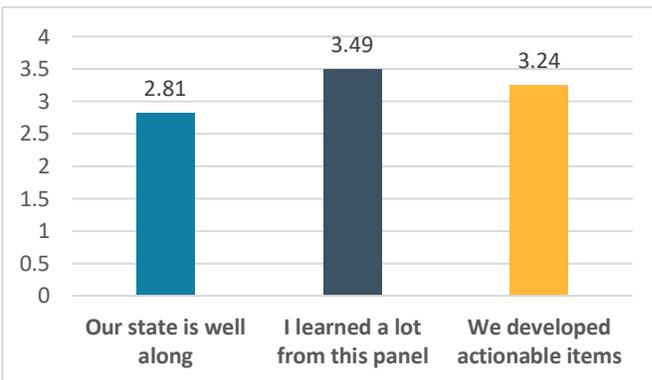


Figure 3: Ensuring that the Work Is Grounded in Equity

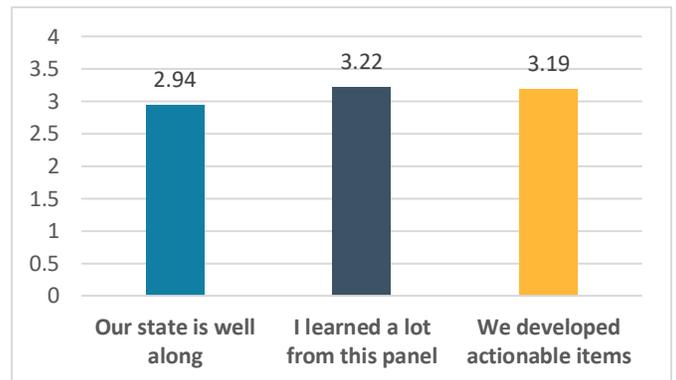


Figure 4: Engaging Government Leadership

In decreasing order of agreement, we see that for each pillar (1) respondents learned a lot, (2) their team developed actionable items, and (3) their state was well along with those ideas. While the order of agreement in each category remained consistent (I learned a lot, we developed actionable items, our state was well along), the differences were slight, from a 2.94 weighted average (*state well along*) to 3.24 (*I learned a lot*). This suggests that the panels were primarily educative but that there was much work to be done by states.

The survey also included three open-response questions that probed more deeply into the value of the conference. Responses, many of which were short or even single words, were then categorized.

Open-Response Question 1: What was the biggest catalyst (that might drive you to action) from the Summit?

Analysis of participants' responses indicated several main categories of catalysts for future action. The most frequently noted categories, with illustrative responses, are summarized in the pages that follow.

Working as a State Team

The most frequently mentioned catalyst was the opportunity to work, without distraction, in state-based teams. A number of respondents noted that even though they were members of the same coalition to promote K–12 CS education in their states, the Summit had provided the first opportunity to meet other team members face to face.

The new connections made between people in my own state.

The biggest catalyst is that we met face-to-face and had the opportunity to build a relationships among each other in addition to developing our position statement.

I really enjoyed the various panels but believe that the state breakouts were most meaningful/productive. It's funny that it takes a trip to Boston to get us together, but those breakouts provided us with the time and focus we needed to reflect on the panels, our progress to date, and the steps we need to take to move forward.

It may seem trivial, but the opportunity for our team (some of us who had never met) to have the gift of time to talk/dream/plan together is likely the biggest catalyst that will drive us to action. Out of our discussions, new alliances, and deeper understandings will come action.

Learning from Experts

A second commonly mentioned catalyst was the panel sessions, which provided helpful examples and expert perspectives on addressing the development of state-level policies for promoting equitable K–12 CS.

I was inspired and motivated by the keynote speakers. Raytheon leader, Mass. Ed. secretary. As a school superintendent, their message really resonated with me. We can do more!

The info from other industry partners.

Need to engage business.

Learning About the Work in Other States

Survey respondents indicated that learning about the work being done in other states also catalyzed their plans for continuing to promote CS education at home.

Networking with the other folks who are in my particular position within their state teams. I look forward to speaking and collaborating with them in the future. I particularly liked the panel on equity. I want to make sure this is in the forefront of our upcoming decisions.

Knowing what other states are doing and who we can look to for models.

The last panel on Government leader support opened our eyes [to] this missing piece for us.

Breaking barriers between industry and education to work together.

Grounding State-Level Work in Promoting Diversity and Equity

The themes of diversity and equity as catalysts for future action also came up often in participants' responses. Comments about diversity tended to be short and non-specific, seeming to serve more as a reminder of a commitment to addressing diversity and equity than efforts to articulate some of the principles or approaches for developing state-level policies to address these issues.

Building equity will be a challenge for our state.

Equity as a cornerstone and a well-established team.

Clearer focus on equity

I particularly liked the panel on equity. I want to make sure this is in the forefront of our upcoming decisions.

Open-Response Question 2: Do you have particular expertise on any topic discussed at the Summit that you would be willing to share with others?

Respondents indicated a number of different types of expertise they would be willing to share with others, as indicated in Table 3.

Table 3: Areas of Expertise

Area of Expertise	% of Responses
Professional training	20%
Government leadership	13%
CS curriculum/curriculum development	14%
Change agent	13%
Equity	13%
Curriculum development	7%
Business partner	7%
Coalition building	7%
School leadership	7%

Open-Response Question 3: Is there a particular topic or issue discussed at the Summit that you would like to pursue further?

Responses fell into several categories, as noted (and ordered in terms of frequency) in Table 4 on the next page.

Table 4: Topics or Issues to Pursue

Topic	% of Responses
Equity	17%
Business engagement	13%
Partnerships	13%
Coalition-building and collaboration	13%
Professional development	13%
Students' CS learning	9%
CS curriculum development	9%
State plan for CS education	9%
Annual state government financial support	4%

Summary of Survey Findings

Overall, participants reported that they found the meeting very useful and generative with regard to moving their state coalitions forward. A number of participants noted that the Summit provided a much-appreciated chance to work together as a larger team and to move their agendas forward. Respondents also indicated that they learned a lot during the two days of the Summit and had developed actionable items for their return to their respective states.

3. Follow-Up Interviews with Leaders of the 10 State Teams

Between July and September 2017, with NSF support, we conducted 18 follow-up interviews with Summit team leads. For nine states, we interviewed two members of each team; for the Washington State team, we were only able to conduct one interview. We also had a follow-up conversation with a Massachusetts team leader in March 2018. Interviews focused on gathering more detailed information about team leaders' experience at the Summit and their work since then with respect to advancing state strategies for equitable K–12 CS education.

Each state coalition brought 8–10 team members to the Summit, all of whom held different roles in their coalitions. In some teams, participants had worked on different aspects of the policy agenda and knew of each other but had not met in person until the meeting.

Reflections on the Summit

Those interviewed thought that the four pillars (i.e., equity, statewide coalitions, business and industry partners, and government engagement) were useful and important ways to

organize the work of the Summit. Several interviewees mentioned related topics (e.g., the importance of legislation for supporting their work) or additional aspects of their efforts (e.g., funding and capacity-building) that received less attention during the Summit. These topics might be useful to include if future meetings are to be planned. Another idea was to organize meetings around challenges to be solved, such as teacher preparation, curriculum and standards, publicity and marketing, advocacy, and diversity and equity.

Every team lead agreed that the uninterrupted time, off-site, was invaluable for moving their work forward.

I think the biggest benefit for us was having that quiet time, being locked in a room to think about [the] problem in more detail with some of the key decision-makers, like the chair of the state board, to strategize about how do we start to build the political will and the political coalition to help advance some of these initiatives at a political legislative policy, government kind of level. *(Interview with Texas team leader #1)*

[The Summit] has been the best conference for actually identifying problems and working on problems and putting plans [together] . . . and holding people accountable for working on those problems and ultimately trying to implement real change back in the state. *(Interview with Texas team leader #1)*

Another benefit was the unusually large number of state team members who were able to attend. A number of interviewees noted that the Summit offered a rare and very welcome opportunity to bring together a critical mass of team members and stakeholders to work together (and sometimes to expand the coalition membership itself). The relatively large size of each team made it possible for people to meet one another face to face, sometimes for the first time, and to talk through the intersecting foci and goals of stakeholders from different constituencies.

For [my state co-leader] and I, we got into this [work] mainly from the equity side of things. And that is a really big-picture reason to do all of this. But then for Arizona, the more immediate challenges for us were also talked about at the meeting—which is that we, like other states, are in a kind of chicken-and-egg setup, where we really want to have CS education for all kids in Arizona. But in order to have that really happen, we need to have standards in place. But in order to have standards in place, we need to have a policy sort of directive coming from the governor level and the Department of Ed. level. And in order for that [to] happen, we need to have some—it would be helpful to have a push from business. In Arizona, that's a real big issue. Our government is really focused—not to say that they're not focused on equity, but I think that something that would speak to the Arizona government is the business side of things. So that's a really important piece. So we're trying to get all of these associated elements that were covered at the Summit moving. We need somebody to move. And it is now happening. . . . One of the nice things about [the Summit] . . . is that it allowed us to bring enough people that we had kind of a critical mass. You know, sometimes you can bring three, four people. But

the ability that we were able to bring, like, nine, ten people—that was a big chunk of our task force. And it just allowed us to have a critical mass of people hearing the message from other states. And so I thought that was a big win from the event. *(Interview with Nevada team leader #1)*

In many cases, I've got subsets and supersets of the same group of individuals [that I talk to within the state and across states]. Your group . . . was more diverse. It wasn't just Department of Ed., [Career and] Technical Ed., and me. The ECEP membership, there's just three team leaders [from our state who attend those meetings]. That's pretty small, and it was refreshing to have other stakeholders in the room. We might do a fair job of anticipating their thoughts and desires, but when they're in the room with you, and they just tell you that it's better, and I think it opened our eyes. *(Interview with Arkansas team leader #2)*

I pretty much had my [State] Plan in process, but it was really good to find out what other people [in the coalition] were working on, and what they could do. I didn't know much about that. . . . I'd already started working with [people from the Department of Ed.], and through the [Summit] meeting found out more of what they were doing. This was the first time I got to speak with both the [district] Superintendents [on our team] . . . It was great to know that both were very interested in implementing this, and serious about it—not as an elective, but as core knowledge that every kid should have. So, getting in contact with them actually helped us brainstorm this pilot [for implementing CS within an entire] district. *(Interview with Massachusetts team leader #2)*

The nature of the team work differed somewhat for different state teams. Some noted that the Summit was unique in that it allowed for a critical mass of team members who were able to solidify buy-in, create implementation plans, and think through legislative priorities and funding for positions. For teams with some new participants, the Summit provided an opportunity for team members to get to know one another, develop trust, begin to uncover underlying assumptions held by different members, and focus on developing a shared set of goals. Teams created new action plans or critically revisited plans that were already in place. The interviewees reported that their groups left excited and enthusiastic, leveraging the energy generated during the Summit to continue their efforts. Some noted that even though they had been working diligently on a number of different fronts, the Summit offered an opportunity to broaden core teams, reflect on work completed, celebrate accomplishments, and look forward to new challenges.

Some of the folks [who came to the Summit] . . . were already on that team, but we broadened our team a little bit. This Summit . . . was an opportunity for us to grow, and not just in numbers but in terms of our vision, and have time to work collaboratively to envision next steps for our state-level implementation of computer science. *(Interview with Washington State team leader)*

The Arkansas group noted that they had already made substantial progress prior to the Summit and were able to celebrate how they quickly “moved the needle” in creating a stand-alone position and organizational backbone. The group left Boston looking to the

continued expansion of their programs and positions, as indicated by a comment from the state lead:

All of the [team members] came away with a greater understanding of how far we've been able to move as a state through legislation, through regulation. . . just blown away by learning what processes [we] have to go through in state government to move things . . . move the needle, so to speak. . . . Listening to some of the other states. . . [they] were just amazed that we were able to move so quickly. . . We have kind of a perfect storm, as I like to say here in Arkansas, and I'm very lucky. . . . When you have the governor of the state saying this [CS education] is a focus of my administration that is beyond value. We also have the benefit of our State Board is appointed by the governor. . . . And then the commissioner's hired by the State Board – not elected. *(Interview with Arkansas team leader #1)*

Benchmarking against other states was invaluable as well, as a state team leader from Nevada pointed out:

Well, for us, it was useful to have that many people . . . that big a chunk of our task force together, listening to what other states were doing. And the ability to go talk to those people, ask them questions, and then kind of come together. Because we would come together, and we'd say, "Well, you know, we heard Arkansas talk about this. What are they doing about that?" And then we had a chance to go run over and chat with them and ask questions. *(Interview with Nevada team leader #1)*

One leader from the Arizona team reported that the time allocated in the Summit to planning helped them develop action steps, which were important for moving their work forward.

I think each of the working sessions where we go to our folks, the people who came from Arizona, to sit down and actually work in real time on, like, our state vision and our goal statement, and then starting to break down what are the specific pieces of the state plan and how can we get those moving forward, and what's the priority. I think that as a direct result of that, we've now gotten things to move forward more quickly in Arizona—despite all the challenges that everybody has. So . . . incredibly, incredibly valuable. *(Interview with Arizona team leader #1)*

Other teams appreciated having the time to focus and take stock of their programs.

It was interesting in that it provided us with a road map that revealed some of the obstacles more clearly that we face, and some of them were in the room with us. *(Interview with Virginia team leader #2)*

So, this particular occasion allowed us to really dig deep into who are the stakeholders and where in the state are we not yet reaching that we need to reach . . . it allowed us to have an opportunity to do some strategy around gap analysis and say, "Who are we not reaching from an equity perspective, and

how are our existing programs, like our grant programs, not serving some of the people that we would intend to serve?" (*Interview with Washington team leader*)

For some states, this stock-taking led to direct action immediately following the Summit.

We have a state-level team working on the grant programs for the next biennium, and that actually did go through, so we have a new round of grants that will be going out this fall . . . and we have, since April, been able to canvas the state a little bit more to get out and meet with some of the people in different regions of our state to do some of the high-level work . . . we've built out our CS for Washington. We've modeled that off other states' "CS for . . ." sites—CS for Texas, CS for Rhode Island. (*Interview with Washington team leader*)

Comments also suggest that the Summit's focus and format were productive and might be profitably replicated at a state level for regional coalition-building.

The *CS for All* movement has done a really good job of talking to ourselves. We've had a lot of meetings. We go to a lot of conferences where we present to each other. What was unique about this meeting, and the biggest takeaway, was for all of these stakeholder groups, for many of the folks that were there, this was the first time that they saw themselves represented as part of a larger movement, and I think that was super valuable. I think for those of us in positions similar to mine, we've been to 20 meetings exactly like this. The meeting itself wasn't all that different. What was different was the people who were participating in it, and for many of them, it was their first time. So, I think finding that sweet spot of building—introducing these concepts for the people who are new to it, and deepening the work for the people that aren't new to it, and I think that was—the way that this meeting was structured was about as close as we're gonna get to accomplishing both of those goals. It was the conversations and then the small-group discussions that followed, [which] was a really, really strong organization for that meeting, for that to happen, I thought. I really appreciated that. (*Interview with California team leader #1*)

Well, the deputy superintendent] and I . . . were talking about trying to potentially partner with [the] Texas Association of School Administrators to replicate a similar experience for teams from school districts. (*Interview with Texas team leader #2*)

Many teams identified learning from and sharing with other states as particularly important, as it helped them gain insight into types of stakeholders who were currently missing from their coalition (often partners from business and industry) and identify next steps for moving forward on each of the four strategic pillars. Teams were also appreciative of having access to and receiving tips and guidance from experts, and they noted that the opportunity to talk with colleagues from other states helped them think through their own issues and learn about approaches that others were taking.

It became very clear to me as I heard some other states that one of our biggest gaps was our relationship working with higher ed. in this space. We've been so K–12-focused that we had kind of neglected our higher ed. partners. And that was one of the things I heard from other states, is that there were some other states doing a much better job of engaging their higher education partners. And so, in fact, that was something that was an action item we brought home. *(Interview with Utah team leader)*

There were many states that had very compelling stories. Some of them were doing similar things that we did, some of them took a completely different path, and I think there [were] lessons that all the states learned from each other, and I really appreciated the networking and the listening to the other states. . . . We sometimes get into our own little echo chamber, and we're pushing what we think is important, and we forget some of the pieces that would enhance everything. I think the exposure to those states, the sharing from each of those states, definitely benefitted [our state team]. . . . All the states were picking all the [other] states' brains. . . . I think that we took more away from the encounter than we perhaps thought we would before we arrived. . . . I think that we are just now—maybe the flashlight's gonna shine in some of the dark corners that we hadn't looked at before. *(Interview with Arkansas team leader #2)*

Just being able to reach out to the other states and say, "Oh, okay, so you did do a strategic plan, what does that look like?" Or, "Oh, you wrote your standards, can I see them?" And so that's where I got a lot of the standards from other states that we're going to use. So, yeah, I can't even imagine doing this role without that coalition. *(Interview with Nevada team leader #2)*

A number of the coalition members we interviewed indicated that the plenary speakers also offered interesting and stimulating perspectives for team discussion.

I do remember thinking that a couple of the keynotes were very effective in sparking conversation, right, kind of planting seeds in the minds of our state team as we got together and started talking. So it gave us a place to start, so we weren't starting off cold. *(Interview with Utah team leader)*

Because we were all in the same room, and we were able to [all attend] the large-group presentations and come back and discuss in our small group. Each time we did that, we were able to add another action step in our plan. *(Interview with California team leader #2)*

4. Unpacking the Four Strategic Pillars

The research and evaluation team members of the project analyzed the interview transcripts for common themes relating to the state leaders' experiences at the Summit (and beyond) in terms of the four strategic pillars.

Engaging Business and Industry

Ironically, while many state leaders observed that connections with business and industry partners were the weakest links in their state coalitions, the business community is viewed as having the most at stake when it comes to supporting CS policy and initiatives. Businesses consistently cite the need for a CS-literate workforce in order to be competitive.

So, you have a lot of strong industry supporters that have a need locally for educated talent . . . if a company can hire someone locally in Arkansas, they're much more likely to stay long-term, be a more committed employee than someone you have to pay to come to the state from elsewhere, who might not like the culture, they may want to go back home to family . . . so companies have an interest in making sure that we have homegrown talent. *(Interview with Arkansas team leader #1)*

While business and industry partners seem to understand the need to educate students at postsecondary, and even secondary, levels, they seem to have more difficulty recognizing that CS literacy starts in elementary education. As a Texas interviewee pointed out, industry's reason for participating in this advocacy work is to ensure future employment opportunities.

My perspective on business and industry has been [that] they tend to be a little more short-sighted on their focus. So, you see more activity at the collegiate level or the high school level, community college level, where the path to a recruit or employee is more immediate. It's a little tougher to get them to pull down into K–12 and see the long-term benefits of that course. . . . IBM, for example, has [the] P-Tech model that they started in New York that we've brought to Texas, and we're starting up some computer science tech schools. I'm not saying they're all like this, but . . . and Google has their CS First program. There are supportive companies. I guess I'm a little surprised to learn how important the skill set is for oil and gas, as the data science and analytics start to become a more significant part of their IP and expertise. *(Interview with Texas team leader #1)*

For other states, getting industry on board as part of the coalition can almost feel like a competitive sport. In Virginia, industry is already overextended, given the multiple players, particularly in the CS programming world. This has been a source of challenge and frustration, as coalitions work to garner more coherent and coordinated industry support for collaboratively developing plans across all sectors within the state to support CS education for all students. Such an approach necessarily goes beyond convincing individual companies to invest in particular programs, particularly at the national level.

Right now, a lot of the air has been taken out of the room by some of the national initiatives, like Girls that Code, Black Girls Code, Code.org. If I go to Microsoft, they say, "Well, we're funding Code.org or TEALS." That's great, but that's not effective state-level policy, or if it is, it's not impacting other things the way that it needs to. *(Interview with Virginia team leader #2)*

Promoting economic health through educating a skilled workforce is definitely the driver for industry, but the question of how to engage industry in this, and for what purposes, is a work

in progress for most states. Industry has historically been pigeonholed as the partner who brings the money to the table to support educational efforts, particularly for coalitions without government funding. Some state leaders stated that industry was necessary simply because government couldn't support CS education alone.

I think the business and industry partners are absolutely key, because if we don't have them engaged, the problem is too big for government to solve it alone. . . . They listen to companies way more than they listen to educators.
(Interview with Texas team leader #2)

There is an exception to this ongoing challenge: Utah has been quite successful in leveraging businesses to make a case to the state legislature for allocating funding to support the development of CS education. Their state leaders have observed that strong advocacy and support from businesses within the state can also rally support from other critical stakeholders by reinforcing the argument that CS education is good for the state's economic health.

We had one company that really stepped up, and it was Dell EMC. . . . Their vice president of operations for the Utah and the North Carolina facilities stepped up. . . . When I talked to him and I invited him to this [Summit], I do remember that the conversation changed. . . . We had a long conversation about, "Well, why Utah? Why are you being asked out of all these states to attend this kind of state leadership summit?" and I told him . . . "Believe it or not, I think we're getting more momentum than a lot of states in this space, and I think everybody's struggling to figure out where to go. And oddly enough, I think we're a little bit ahead of the curve. . ." And that changed Vance's kind of outlook on all of this . . . he's now become the chair of our board. He brought on Adobe. We've got 3M. We've got Intermountain Healthcare, our largest—one of our largest employers in the state. Hill Air Force Base. I mean, a lot of other companies—Boeing—came on board, because once you've got a Dell [on board], he mitigated the risk for everybody else. So it was just this huge, almost within a week, snowball effect. It gave our initiative kind of almost overnight credibility. . . . It's kind of this downstream effect . . . you get your business [or] industry on board, and then all of a sudden your legislators won't say no. *(Interview with Utah team leader)*

Leaders from other states also observed that using industry's economic power can be a game-changer in terms of getting political buy-in.

To have someone come in and say, "Hey, we're not gonna open up a new factory here because we can't hire the workers," that will hit them where they live. *(Interview with Arizona team leader #1)*

The nature and structure of the industry involvement, however, needs to be considered carefully. In Massachusetts, where the current structure of CS advocacy involves having business, industry, and other private funders primarily, but not exclusively, contribute to a public-private partnership, funding from the state is released when business partners have provided matching funds. In a recent follow-up conversation, a Massachusetts coalition

leader expanded on the challenges of this model and the kind of flexible thinking necessary to engage business partners in educational efforts that have the promise of achieving the necessary scale to meet statewide goals:

After reflecting on the feedback from the business community, it became clear that in spite of our track record working with partners to provide [professional development] to almost a thousand teachers and achieving several policy victories, they felt we still had no credible strategy to really scale K–12 CS in the next five years. So, the first step we took was to talk to the Superintendent on our Advisory Board about shifting our focus away from an individual teacher to an entire district. The superintendent agreed this would likely be a much more effective and sustainable scaling strategy, and he suggested meeting with the leadership of the Mass. Association of School Superintendents. After several months of information-sharing and fairly intense meetings, the Association is on board with making K–12 CS one of their top priorities. Interestingly, several business trade associations were very interested in the new collaboration with the Superintendents, as they felt this was a much more viable scaling strategy. They encouraged us to return once a more formal implementation plan was developed. *(Follow-up interview with Massachusetts team leader #1, March 23, 2018)*

Having all three sectors—education, government, and industry—working together requires extraordinary leadership, delegated day-to-day management, and a sustained effort to keep partners at the table and engaged.

I think our business rep has been bringing stuff up regularly to the Tech Council, but I think his vision is, or his view is, we need to have a more solid ask. Like, how do you present things to the tech industry? We need to have a more solid ask. So, I think our opportunity now, though, is to get matching funds from what the legislature is giving us for the standards. So the way we want to go about it is like, “Hey, we’ve got this money, now we’re looking for industry to match it.” So, that’s kind of our first attempt at getting funding, so we’ll see. *(Interview with Arizona team leader #2)*

We have a lot of support and pushing from outside entities asking for us to step up to the plate. We have top-down from the government, and we also have this private group of very strong corporations that have said this is something we want. So my job—which is in government—was to take this and get the K–12 and the postsecondary systems to actually say yes, we are going to do something. That’s my job, connecting all three. Corporate doesn’t care about words on a page, they care about results. *(Interview with Arkansas team leader #1)*

For states that do not have this trifecta of pillars supporting the equitable CS agenda (which is the case for the majority of states attending the Summit), coalitions are moving forward with just one or two of the critical stakeholder sectors—often just education and government, or a combination of both, doing the heavy lifting. However, when all three sectors work together, sustainable line-item funding is more likely to result.

Unless something has changed in the past 24 hours, we still have the largest commitment of any state in the nation specific to CS education. We put \$10 million over four years, and it is now a line item in the budget. *(Interview with Arkansas team leader #1)*

In some states, such as Maryland, the business focus is more on offering in-kind support to schools, rather than providing direct funding and/or applying pressure to the legislature to allocate funds to the state. This model, however, fails to provide sustainable state-level support for CS, and leaves coalition members spending energy simply working to sustain current efforts rather than growing a long-game commitment to CS education for all of the state's children.

I think we haven't quite figured out how to connect businesses with things that they really could do with either in-kind contributions or employee time, or more resources that fill gaps more, equipment donations, cash donations—like, if they were going to give some money, who would they give it to? What's the place? . . . We would ultimately want a third of the funding to be coming from the state legislature through direct or indirect grants, a third of it from outside funding from NSF or foundations, and a third of it from industry through some kind of sponsorship or underwriting particular events. *(Interview with Maryland team leader #1)*

Developing Statewide Leadership Coalitions

The coalitions had an impressive array of representatives from many sectors of the education community: from higher education to secondary education, from teachers to superintendents, from advocacy groups to government officials. However, respondents focused mostly on the state's educational entity—the department of education—as a necessary relationship. Arkansas has a position dedicated to CS within its department of education; Nevada and Massachusetts are excited to have a person inside their departments of education who will drive policy and implementation. Having a champion with a directive, one who is also open to collaboration, is effective for advancing CS policy.

Other states noted that they experienced some challenges in creating a coalition where stakeholders from different sectors can create a truly shared vision, one that supports coordination of efforts across the whole team. In some cases, interviewees described having to work around stakeholders who did not buy in to the vision (or perhaps the approach for reaching the vision), or jockeying for turf among different constituencies. They told of instances where members agreed to a plan for moving forward but then seemed to make decisions and take actions that were inconsistent with the original plan, or when potential stakeholders shared some of their goals and values but also were their competitors for limited resources.

I've not had much success in getting the department of ed. directly involved; [instead,] we've gone to other departments of the state that fall under the governor's office that have a stake in this . . . like [the] Tourism Commission. *(Interview with Virginia team leader #2)*

They [higher education advocates] tried to kill our [CS education] bill [in the legislature]. You can get resistance to a good idea just because people are afraid they'll end up on the losing end. The math people don't think CS is math, and the science people don't think CS is science. There were efforts to get more computational problem solving in [the] Next Generation Science Standards, but they weren't interested, so they created their own competition. We tried to work with them. *(Interview with Nevada team leader #1)*

Where [CS] lives [in the high schools] is a challenge because right now . . . If you were to start *de novo*, you could imagine putting it in the CTE [career and technical education] side, or you could imagine putting it where math and science and social studies are in the curriculum side. Right now, it's in the CTE side [for reasons related to Perkins funding]. *(Interview with Maryland team leader #1)*

Code.org, the most robust of the national CS coding organizations, has been a strong ally of many state coalitions on the policy front—in particular, through its focus on teacher professional development, which is having an impact on schools and districts around the country. In Virginia, Code.org played an instrumental role in helping the state coalition, CodeVA, get a range of CS policies on the table and discussed in the public arena. As the coalition developed, CodeVA was to be the implementer, but a funding snafu prevented that from happening—and these kinds of snafus are common occurrences among these leading states.

Ensuring that the Work Is Grounded in Equity

Overall, states responded that equity played the largest role in driving their CS missions and how to make CS available to the most students. Representatives from Texas and Washington stated this perspective especially well:

We are all about expanding access to and participation in computer science education for a greater number of students in K–12. That's a high priority, a guiding principle of what we do and why we're all doing this. *(Interview with Texas team leader #2)*

Well, I'd say that our team has really been focused around equity from the outset. We think that [the team's] fundamentally all about equity because we have enormous gaps in terms of underrepresentation. *(Interview with Washington State team leader)*

At the same time, a number of interviewees noted that equity represented a different type of pillar than the other three, serving more as a guiding principle for social justice that undergirds and informs all other policies, plans, and actions.

We did say that equity was the goal and not a strategy. So, our strategy should address equity, and we should come up with strategies for addressing equity. . . the state coalition, and the business and industry partners, and government would help us get that. *(Interview with Massachusetts team leader #2)*

So, equity is really the framing of all of the work . . . and I think that's been a more explicit goal for us. . . . I think equity is really where we are anchored in our work. . . . This may be bold, but computer science [is actually] secondary to [our focus on] equity. But our goal is equity, and computer science becomes a window into inequities and inequalities in education. . . . So, when our team met, there was agreement that [equity] ought to be a priority, that there are many people that can do computer science education, but there are not many people who can do computer science education and have an eye toward equity. *(Interview with California team leader #1)*

Challenges to Envisioning and Enacting Equitable CS

Fully supporting equity for most meant limiting implementation until policymakers are sure that every student in the state can gain access to CS courses. However, the notion of access seemed to mean different things to different team leaders, for example:

- Making (at least) one CS course available in high school
- Making CS a graduation requirement for high school
- Developing CS courses and/or opportunities for students in middle school (and sometimes also elementary school)

Among those we interviewed, attention to equity also seemed to involve one (or more) of the following:

- Training more teachers in order to offer more courses
- Getting more girls involved in CS courses and/or activities
- Getting more under-represented students (e.g., students of color, students from under-resourced environments, English learners) involved in CS courses and/or activities

Team leaders also noted that resource limitations—equipment, connectivity, qualified teachers—also limited equitable opportunities. These limitations must be addressed and mitigated as we move toward the goal of equity.

Engaging Government Leadership

The governor is clearly seen as playing an important role in efforts to promote statewide CS efforts. Having the governor actively support CS efforts engenders a strong mandate, alignment within a state's administrative departments (through appointments and directives), and access to funding.

When you have the governor of the state saying this is a focus of his administration, that is beyond value . . . and his appointments, like the State Board. For success and for it to be a statewide initiative, [the governor] not only needs to create the position, it needs to be focused only on CS. *(Interview with Arkansas team leader #1)*

My governor hasn't been given the messaging to take [CS] forward . . . there's nobody advocating at a cabinet level to the governor. (*Interview with Virginia team leader #2*)

So, one of the big "aha moments" for us was, for example, the governor's office. So, we don't have a particularly active governor who's been a governor around computer science education. They're aware of what we do, we keep them up to date, but it's not a key policy objective for the executive branch in the state. But what we did figure out is, there are some objectives coming out of the governor's office that kind of align education with workforce development, and there were existing committees and reports to work on that problem, and . . . many of the solutions that the committees came up with were related to STEM education and computer science education, specifically. So, that was a new strategy for us to try to broaden our reach and kind of elevate the importance of CS education and the overall state political spectrum. (*Interview with Texas team leader #1*)

Interviewees' comments underscored the role of the governor in helping to advance a CS education agenda. Members of several state teams reported cultivating candidates for upcoming gubernatorial races, and slowing down some of their work until newly (or soon-to-be) elected governors articulated their priorities for education, or until upcoming gubernatorial races had been decided.

Code.org actually has been working on [our] governor to join the "Governors for CS"—and that just happened. So, that's good. That's an overt commitment . . . We have a gubernatorial race this year, and two of the candidates who are running for governor have made computer science education part of their platform. (*Interview with Maryland team leader #1*)

So, one short-term goal that we have and that we identified at that meeting was, how do we influence the governor's appointments for that strategic plan? That's one area as a short-term [goal]. The second . . . is influencing the governor's race, which will be in another year, so how do we get the next governor to buy in and make commitments around computer science education and continue the momentum, because that needs to be led by the governor. (*Interview with California team leader #1*)

We're . . . working with all the different agencies, and we have a new governor coming in later this year. The governor's office hasn't—once everyone's leaving in the Department of Ed., at the secretary level and all that, it's harder to get commitments to put people on committees and things, as things are changing. We're hoping by later this fall we'll have a seeded committee, and that can help us figure out where we go from here. (*Interview with Virginia team leader #1*)

However, states without strong gubernatorial support have had to be creative about finding other avenues for acquiring legislative support for their work by seeking out legislators who will carry the banner of CS education into state congressional chambers.

Massachusetts has been fortunate to have two very strong legislative champions. The Speaker of the House has been a singularly strong champion, assuring that \$1.5 million in funding to support MassCAN [a state-based advocacy organization for equitable K–12 CS education] has been in the budget for the past five years. . . . In the Senate, the Chair of the Ways and Means Committee has been an equally strong champion, supporting the annual \$1.5 million allocation. The Governor, elected three years ago, has included MassCAN in major budget cuts he made during two of the last three years in order to keep the state budget in balance . . . the House and Senate have overridden those cuts. (*Follow-up interview with Massachusetts team leader #1, March 23, 2018*)

State CS education advocates often stress the importance of CS to government officials by focusing on the key role of CS in the future of work and the economy.

Computing is what our rural districts can really play. It's not like advanced composites or biomedical device-type stuff, where you need a critical mass to justify that capital investment for the infrastructure to build that in high schools. . . . So we shifted both of our sponsors to rural legislators . . . We shifted our entire model to be not just on the urban front, but really to put an emphasis on the rural districts and how [CS could support the state's] economic development. (*Interview with Utah team leader*)

The establishment of the "Governors for CS" organization, co-chaired by governors from states attending the Summit, has helped to elevate the visibility of CS education as an important state goal and has created a growing cross-state coalition of advocates for CS at the highest levels of state government. At the end of 2017, 16 governors were members of this group, 6 of them from states attending the Summit.

5. Additional Areas of Coalition Work at the Summit

CS Implementation

Implementation varies as states prioritize different activities to bring CS into schools. Unfortunately, CS is diffuse; it doesn't have a tangible home or a clear definition. In addition, the coalitions work across a number of agencies responsible for different parts of CS, including curriculum development, professional development, course requirements, graduation requirements, and teacher certification and licensure. All the players can have differing ideas about what CS is, where it should live, and how it should be implemented, thus creating the need for a common language and definition.

An example of the distance between current CS ideas and those in the field was reported by a Virginia team leader, describing a rural principal and his idea about CS:

So, ask him what computer science is, and while he knows it's important, he was defining it as all manner of things, and it still included things like typing and data processing from a standpoint of [I'm doing computer science if I'm].

. . . word-processing kind of stuff. Or [he would count] advanced manufacturing as computer science. . . .So he sees it that way . . . it's a skill you learn, and then you go and use it in the workforce. *(Interview with Virginia team leader #2)*

Another area of debate is where CS fits within frameworks and standards. Some see it as a stand-alone standard or framework, while others see it as part of the math and/or science standards. And, as a team member from Nevada pointed out, there is some bad blood with the math and science folks:

The truth is, math and science both had a chance to bring computer science in. There was computing in the core. There was an effort to get those skill sets in common core math, and the math people weren't interested. There was an effort to get more computational problem solving in [the] Next Generation Science Standards, and [the NGSS writers] weren't interested. So they've created their own competition. *(Interview with Nevada team leader #1)*

This tension was clearly on display when Nevada was working to pass its CS bill:

The most resistance we've gotten is from Higher Ed. They don't want CS to count toward math or science, because their math people don't think it's math, and their science people don't think it's science. They tried to kill our bill. *(Interview with Nevada team leader #1)*

Where to put CS isn't an easy decision either. In Maryland, superintendents have the power to change curriculum, which happens county by county. In Montgomery County, the superintendent had CS become part of the technology education requirement, which was not an easy task. Of the 44 standards for technology education, which mostly refer to engineering and technology, computers were not mentioned at all. The technology education communities are very protective of what they've achieved, and they don't want to be undermined.

He's the one who actually, essentially, signed the executive order saying computer science can count to satisfy technology education requirements, so that was very much his legacy. That didn't go through the Maryland State Legislature. It was just done as an internal order in [the Maryland State Department of Education]. *(Interview with Maryland team leader #1)*

Maryland continues to struggle as it pushes CS within technology education for CTE.

The confusion over where to put CS is found in many areas. For example, how many classes will be needed to satisfy the standards, and what will those classes be?

In five years, every high school will have to offer computer science. [The state] mandates computer science standards, allows it to count for a fourth math or a third science. It pushes what we would call computer literacy down into elementary school. It actually took our task force and turned it into a statutorily mandated subcommittee of the STEM advisory council. *(Interview with Nevada team leader #1)*

The big issue everyone is working on is teacher training. How will teachers be prepared to teach CS? What happens at the college level, and what is available for teachers already in classrooms? As one interviewee pointed out:

The pre-service teacher prep is something that still needs a lot of work.
(Interview with Maryland team leader #1)

Maryland offers a good example of how difficult it can be to work with the state university system to prepare future teachers. When asked about getting faculty to teach CS education courses, one team member shared:

[The college faculty] don't have anybody that does computer science education. They don't see it as a priority, [and] they're not likely to put it at the top of the list. If they've got a new faculty position, why would they hire somebody in that area when they see . . . their bread and butter as math teacher preparation? *(Interview with Maryland team leader #1)*

Arizona has a similar issue with CS teacher education:

So, there aren't a lot of places to insert something like a concentration in computer science education. Although we have examples. 'Cause we have, like, an early childhood development sort of concentration. . . . We're trying to find a way to integrate computer science education into both the concentration for people who will really go out into the classroom, and then more generally as maybe an elective or to fulfill a sort of technology integration requirement for the regular preservice teacher degree. It's a real goal. So, we're getting there, but it's, again, I guess not moving as quickly as I would like. *(Interview with Arizona team leader #1)*

Working with school administrators and counselors is important as well.

I think a lot of school counselors steer students away from CS because they don't think it's relevant for them, either because they're not [at] the top of the class academically or because they're girls, or they just don't see the relevance. "Oh, you're not going to be a CS major, so why would you take this class? You're more interested in the humanities, so why would you take that class?" Well, everyone should take these classes. *(Interview with Maryland team leader #1)*

A team member from Virginia was also concerned about the impact on a student's higher education choices:

I'm substituting math and science credits with computer science credits, and when I go to college, they don't recognize computer science that way, and they're not going to. It's not a science credit, necessarily. [In] some states it is, some places it's not, but it's definitely not your higher math, if you didn't take calculus and took CS instead. *(Interview with Virginia team leader #2)*

An excerpt from the interview with Virginia team leader #2 details this concern:

Interviewer: So, are kids not getting into school, or are they stuck taking calculus then, in kind of a—

Respondent: They would simply not get into some of the better schools in Virginia—like, UVA or Tech would just say, “No. You don’t have those higher math credits that we want to see from a graduate.” And you were required to take them. There it is in the graduation requirements, but you substituted them with this alternative that is allowed by law or by whatever. . .and so they did away with that alternative to the math requirement.

Interviewer: Interesting. Would guidance counselors be able to help kids navigate that?

Respondent: If they knew a dang thing about computer science, yeah, but their objective is to get a kid graduated.

It is no surprise that integrating CS into teacher professional development (PD) would be a primary pathway, and as such, we see most coalitions doing just that. As a Texas team member put it:

How do we get more trained teachers? Our focus is 100% on teacher readiness, PD, and training. (*Interview with Texas team leader #1*)

Virginia has a model that has trained over 1,500 teachers statewide from private money. Others are using Code.org to train their teachers. Arkansas is providing its own comprehensive training statewide from elementary through high school:

Growing that teacher capacity, that’s 90 percent of our efforts. So, we have hired as of today seven computer science statewide specialists that provide our PD across the state. We work together, or they work as a team . . . though they work under our educational cooperative system. But we worked and we’re—we developed and are delivering five PDs across the state in every co-op this summer. It’s been going really well. We are trying to ramp up the incentives for teachers to gain that high school certification, or take the lower-level professional developments.

We’ve announced a \$2,000 stipend for teachers that will add the high school certification, for example, and [require them to] teach one year—at least one year—of CS. My nonprofit, we are putting additional money [toward] that, if the teacher’s in a high-need area [or a] low socioeconomic area, or the school doesn’t have a CS teacher yet. So, my nonprofit has a goal to see at least one CS teacher in every high school across the state, because a lot of our schools are still using virtual offerings for their CS course. And while we think that is an option, there is always benefit to having a face-to-face champion for CS in that school. (*Interview with Arkansas team leader #1*)

Arkansas is working to develop a unified licensure system: aligning course codes and creating new course grids. With coalitions struggling with how to code courses and what combination of courses will meet the CS requirements, this is an important step.

Finally, it's important to note that there is no linear sequence to implementation. To be successful, coalitions need a person leading the charge, a common language and agenda, collaboration across and trust among partners, persistence, time, and the ability to remember that in the end, it's about the students.

6. Summary and Conclusions

The Summit was organized to bring leading states together to help them reinforce their progress, share and solve persistent problems, and develop a draft action plan of steps to take on returning home. The state membership structure for the meeting—people filling 10 very similar roles in each state—had several benefits. A critical mass of leaders within each state were able to meet as a group over two days, discuss, build trust, problem-solve, and develop some initial actions plans to take back home. Attendees indicated that this broadly representative group brought new information to the table and helped them identify key parties who were not currently part of their leadership group. State leaders left the Summit with a stronger commitment and greater buy-in to their coalition's work around an agenda and action plan.

In reflecting on the Summit itself, the feedback from the attendees, and the responses of state leaders during follow-up interviews, it seems clear that equity was both the most complex and challenging issue addressed during the two days. Indeed, Table 4. (Page9) indicated that "Equity" received the largest % of responses (19%) to the survey question "Topics or issues to pursue" The Summit experience strongly suggests that early-stage strategies for providing CS education for all K–12 students have importantly contributed to raising visibility and providing a range of new resources. However, while such necessary, foundational tools are critical early-stage contributions, they are insufficient to address the broad-based and deeply rooted institutional and cultural factors that make attaining progress in equity such a daunting challenge. Perhaps there is a need for a special national convening to identify near-term and long-term research, program, and policy strategies to advance the equity agenda for K–12 CS education.

While educational decisions fall under the purview of individual states, some Summit team leaders also noted the lack of a national coordinating entity to support states in their efforts by sharing resources, lessons learned, successful strategies for addressing the four pillars, and connections between state-level policy and implementation at the district and school levels.

What I feel like the movement is lacking is a formal coordinating body of the state of the states. There is not a place for all 50 states and territories to convene to advocate or compare notes to assign action items to implement and track the 10 policy objectives [outlined by Code.org and addressed in the State of the States Landscape report]. . . . Code.org has become the closest

proxy to being the steward and manager, if you will, of the state of the states. I would love nothing else than to have a “CS4XX” for every state, and every state have a governing body, organizing body working on the 10 policy objectives, and we use the collective voice of all of the states to push this through. From a movement standpoint, we’re too fragmented. The governors for CS and national governor’s alliance or association, the CS Ed. coalition . . . all of these places are working on the problem, but there’s not a national backbone organization for the CS education movement. Code.org, I would submit, is the closest. *(Interview with Texas team leader #1)*

The intent of the Summit was to provide an opportunity for states at the forefront of developing state-level policy to experience and/or shape such a coordinated effort. The perceived success of the Summit suggests that a national coordinated effort could play an important role in advancing the CS education agendas for states, regardless of whether states have made substantial progress toward developing and implementing strategic policies (as had the 10 states participating in the Summit) or are earlier in the process of giving statewide attention to CS education.

The precarious nature of MassCAN’s annual funding precluded its following up on the positive feedback from the conference with key state leaders to explore whether there might be a way to either further explore the rationale and support for a conference to address K–12 CS equity issues, or see whether it made sense to build on or modify the national Summit experience going forward to provide a forum for leadership states to continue to learn from one another and develop a strategy to disseminate lessons learned.





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