DISCOVER

BROADENING PARTICIPATION IN COMPUTING | Landscape Report Toolkit

ECEP Expanding Computing Education Pathways

TACC TEXAS ADVANCED COMPUTING CENTER

DISCOVER

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PURPOSE OF THIS TOOLKIT

THIS TOOLKIT IS DESIGNED TO:

- Promote a framework for creating a landscape report that supports state level Broadening Participation in Computing (BPC) efforts which lead to sustainable changes
- Outline the purpose and intended outcomes of a Computer Science (CS) Education Landscape Report
- Highlight the importance of having data that grounds BPC strategy and leads to action
- Center the role of data in CS education advocacy and policy efforts
- Share best practices and lessons learned from states that have developed a landscape report

This toolkit is intended as a first-stage resource for states seeking to develop a CS Education Landscape report identifying disparities in K-16 CS education access, participation, and retention in their state. The toolkit outlines a method for data collection and utilization that shines a light on the demographics of students who have access to and participate in CS course offerings, as well as the state context for CS education.

Historically, landscape reports are developed by broad based teams[1] of researchers, educators, school administrators, community members and industry representatives who are advocating for CS education policy reform. Teams are focused on increasing the number and diversity of students in K-16 CS courses and computing-related degrees, which will look different across contexts and states. This toolkit is intended for state teams interested in collecting and utilizing data to increase their understanding of the state of CS education in their school, school district or state as it pertains to the diversity of students in CS education pathways.

ECEP is developing a more detailed data collection framework for states that have already completed a CS Education Landscape Report and are ready to take their efforts to the next level. As ECEP makes progress on this new framework, additional resources and recommendations will be added to this toolkit.

ECEP'S MODEL OF STATE CHANGE

WHAT IS THE ECEP ALLIANCE?

The Equity in Computing Education Policies, Pathways, and Practices (ECEP 3) Alliance is committed to state-level computing education enhancements aimed at increasing the number and diversity of students in computing and computing-intensive degree pathways. Comprised of state and local K-12 and postsecondary CS stakeholders in 22 states and the territory of Puerto Rico, the ECEP Alliance applies a collective impact model to broaden participation in computing (BPC), creating and implementing state-level support mechanisms, articulating BPC metrics, and measuring state BPC goals.

The ECEP Alliance supports state teams in designing and testing interventions to facilitate systemic change, creating tools and resources for state-level support, defining BPC indicators (see 'What Is Broadening Participation in Computing (BPC) below), and measuring state BPC goals. The work of the Alliance centers diversity, equity, and inclusion in all of our strategies by constantly asking the question, 'How will this strategy/project/effort increase the diversity of students in CS pathways?'

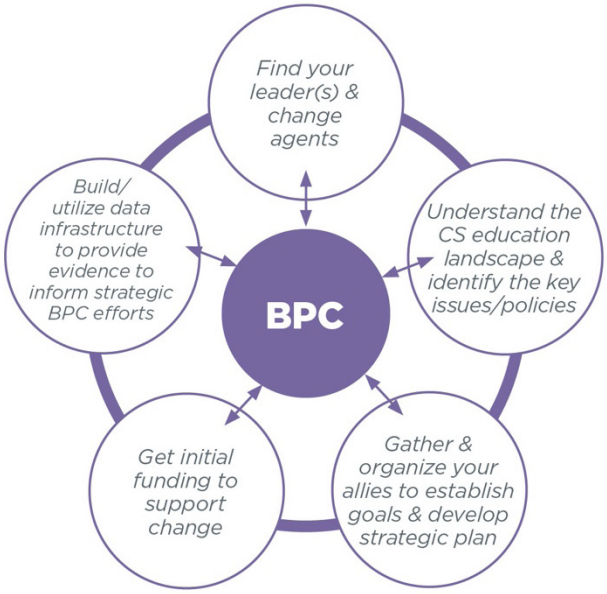
ECEP is housed at the University of Texas at Austin's Texas Advanced Computing Center (TACC) and supported by a dispersed leadership team at Indiana University Bloomington, The University of California at Irvine, and The Massachusetts Green High Performance Computing Center.

[1] ECEP's Common BPC Stakeholders

BROADENING PARTICIPATION IN COMPUTING

The NSF supports ECEP through its Broadening Participation in Computing (BPC) program, targeted at substantially increasing the population of U.S. citizens and permanent residents obtaining postsecondary degrees in computing disciplines, and enhancing the involvement of marginalized groups in computing, including but not limited to "women, persons with disabilities, Blacks and African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, and Pacific Islanders".)[2]

THE ECEP STATE CHANGE MODEL



Understanding the CS education landscape and identifying key issues and policies in a state is a key stage in the ECEP 5-Stage Model of State Change.[3] No matter where a state team begins its BPC work, understanding the landscape of K -16 CS education positions advocates within a state for informed action. States must develop strategies for BPC that are grounded in a substantive understanding of the current landscape and data that is disaggregated such that stakeholders and advocates can identify gaps in equity and student opportunity. In short, states can't design a roadmap for meaningful improvement if they don't know where they are starting.

DATA CAN MAKE THE CASE FOR BROADENING PARTICIPATION IN COMPUTING

Underserved populations can be defined as student subgroups in which their representation in CS course-taking falls below their representation in the general student population. Students can be underserved in CS due to several reasons, including but not limited to (1) lack of access, (2) access but lower participation, and (3) participation but primarily in lower-level CS courses, not advanced courses that may prepare them for college-level coursework. Inequities in student access and participation may stem from any number of factors, including fewer (or no) teachers with the preparation or licensing credentials to teach CS, offering of CS as an opt-in offering or program exclusively for students identified for participation in gifted and talented programming, or perceptions among adults responsible for helping middle and high school students make scheduling and course decisions that CS is or isn't a good choice for them, based on attributes other than students' interest in and potential aptitude for CS. Lower participation among some student subgroups may also be more indicative of a lack of information on CS career options, lack of representative role models in CS, or other systemic factors resulting in students not being invited into or pursuing CS course participation.

A landscape report can provide all CS stakeholders with a common and substantive understanding of the current gaps in student CS opportunity statewide, as defined by CS course access and participation by student geographic, demographic, and academic factors. Landscape reports can also highlight the systems within a state that either support or create obstacles to equitable CS education. Reporting existing gaps in CS education opportunities can generate broad-based support for the development of state BPC indicators, the development of BPC goals, implementation of state and local policies to enhance BPC, and the tracking of progress toward BPC goals.

[2] https://beta.nsf.gov/funding/opportunities/broadening-participation-computing-bpc-0
[3] ECEP 5-Stage Model of State Change: https://ecepalliance.org/resources/how-change-state

To further understand a state's CS education landscape, stakeholders need to consider the intersectionality of data, or how two or more aspects of students' geographic, demographic, or academic backgrounds might play out. For example, looking exclusively at students' overall CS course participation rates by race might mask significant differences in CS course taking by student gender and race. Or comparing student demographic representation in all CS courses against student demographics statewide may mask marginalization of women and girls and students of specific racial/ethnic backgrounds in advanced CS coursework.

A landscape report should document disparities in CS education access and participation among specific student groups such as women, students of color, rural students, low-income students, students with disabilities, and students with intersectional identities (such as rural, Black females) to make the case for specific state and local policies supporting BPC. It can also highlight change makers who are already engaged in efforts to expand computing, or the systems within a state that are part of CS education pathways.

Numerous research studies have demonstrated that access to CS instruction often varies by student and school characteristics such as student race/ethnicity, school poverty concentration, community type, and school size. Landscape report development should consider a broad range of studies and data, to ensure a comprehensive view of gaps and potential opportunities for BPC strategies.

- Warner, J. R., Childs, J., Fletcher, C. L., Martin, N., & Kennedy, M. (2021). Quantifying disparities in computer science education: Access, participation, and intersectionality. In Proceedings of the 52nd ACM Technical Symposium on Computer Science Education, 619-625. https://doi.org/10.1145/3408877.3432392
- Margolis, Jane. Stuck in the Shallow End: Education, Race, and Computing. Cambridge, Mass: MIT Press, 2008. https://mitpress.mit.edu/books/stuck-shallow-end
- Boda, P. A., & McGee, S. (2021). Broadening participation and success in AP CSA: Predictive modeling from three years of data. In Proceedings of the 52nd ACM Technical Symposium on Computer Science Education (pp. 626-632). https://doi.org/10.1145/3408877.3432421]

WHAT IS A LANDSCAPE REPORT?

A landscape report is a broad report of data relevant to state-level CS education advocacy and policy reform efforts. Reports can help states (1) make strategic decisions, (2) create action plans, and (3) help tell the story of why BPC work is such an important issue in education for your state. Landscape reports may include data from readily available public sources such as a state education agency (SEA) or local education agencies (LEAs). Adding national data to a landscape report can provide points of comparison, or help states see a trajectory for their work. Landscape reports may also include new data sets, resulting from newly designed surveys asking for information specific to a state, district, school, or groups of students and educators.

There is no ideal landscape report. This guide is designed to help your team identify the currently available data most relevant to your state work to broaden participation in computing and use the data to drive strategic efforts to achieve BPC. Some states will choose to publish their data; others will use the data internally to better coordinate their work. This data can provide an anchor for defining goals and strategies, team building, identifying resource needs and priorities for investment or policy change, and securing resources for sustainability. How the data is used depends on where a state team is in their BPC work and what goals and strategies they have identified.

ECEP LANDSCAPE REPORTS

Since ECEP was launched in 2012, 70% of ECEP states have produced a public or internal landscape report to support their state-wide BPC advocacy.

Examples can be reviewed here:
https://ecepalliance.org/resources/landscape-reports

While the purpose and intended outcomes of the landscape report may change after initial data collection has begun, it can be helpful when approaching potential team members to have a general idea of the purpose and intended outcomes of the report, and what outcomes you hope for the report to inform. For this reason, it is important to consider a timeline for your landscape report process. (see section "Where do we start? on pg. 18).

TEMPLATE: HOW TO MAKE THE ASK TO PROSPECTIVE TEAM MEMBERS

When reaching out to ask CS stakeholders in your state to serve as state team members, it's important to include key pieces of information in your data request. The prompts below offer a starting point for these conversations with potential state team members.

- **Introduce yourself:** Hi, [name of prospective team member]. I'm [name], [title] from [organizational affiliation].
- **State the purpose/intended outcomes of the landscape report:** I'm organizing a small team to develop a [name of state] landscape report to help state and local CS stakeholders, including state and district leaders, to [name one or more intended outcomes, for example, "Identify disparities in equitable K-12 student access by student background and geography to quality CS learning opportunities and recommend state and local policy changes to increase CS participation and success among students currently underrepresented in CS coursework in our state"].
- **Why you want this stakeholder on the team:** Your name came up because your [name this individual's qualifications or skills that you'd like them to contribute to the report] would really help us gather the data we need and effectively communicate to the audience we hope to reach.
- **Timeline for developing landscape report:** We're looking at starting research in [month/year] and hoping to wrap up in [month/year].
- **Specific contribution you're asking this stakeholder to make to the effort:** We'd especially like to tap your expertise on/in [specific research or writing tasks associated with developing the report] and would estimate we'd need [insert number of days or hours] in [which months of the project] to get that done.
- **Compensation: Either:**
  - [Mention any supplemental compensation secured to cover this person's time on the project], or
  - Unfortunately, we would not have additional funds to support your time committed to this project.
- **Closing:** What questions do you have about this project, and/or your role in it? Would you be interested in and available to support us in developing this landscape report?]

There is no ideal landscape report team. The membership of the team making data requests and analyzing the data will vary depending upon multiple considerations but will likely be a broad-based team consisting of researchers, educators, school administrators, community members and industry representatives.

In general, teams working to develop a landscape report should include representatives from four key categories: 1) data gathering, 2) data analysis, 3) data reporting (writing), and 4) data utilization (strategy development).

The landscape report project leaders need to determine which CS stakeholders in the state to invite to join the team that will be developing the landscape report. CS stakeholders to consider may include representatives of the research community (e.g., a postsecondary institution-embedded researcher); one or more data specialists from a university or state agency; a LEA (e.g., from a school district or charter school); and a SEA representative (e.g., department of education specialist in computer science).

BUILDING YOUR TEAM

Key team members should include leaders from SEAs, researchers in higher education, as well as school administrators and teachers. The more diverse your team, in expertise and demographics, the more likely it is that a team will be able to identify relevant data, ask the right questions at the right time, and be able to interpret the data in service of BPC.

STAKEHOLDERS INVOLVED WITH BPC

State-Level Decision Makers
State Departments of Education
Governor's Office
Policy Makers
Legislators
Economic Development Planners

Business & Industry
Workforce Investment Boards
Technology Hubs
Investors

K-12
LEA Public Schools
Teachers
Curriculum Developers
Professional Development Providers
Career & Technical Education
Administrators (LEA & School levels)
Professional School Counselors
Private Schools
School Boards

Higher Education
Community Colleges
Minority Serving Institutions (MSIs)
Historically Black Colleges & Universities (HBCUs)
Tribal College & Universities (TCUs)
Hispanic Serving Institutions (HSIs)
Asian American, Native American & Pacific Islander Serving Institutions (AANAPISIs)

Students, Parents, Caregivers

Educational Researchers, Data Specialists, Evaluators

Local & National CS Leaders
ECEP
NCWIT
National Science Foundation
Computer Science Teachers Association (CSTA)
CSTA Chapter Leaders
Code.org & Code.org Advocacy Coalition
CSforALL Consortium
Professional Development Providers
Curriculum Development Providers

STEM Center Leaders

Nonprofit & Community-Based Organizations
Informal Education
After-School & Out of School Programs
Museum Educators
Summer Programs & Camps

Funders
Federal (NSF, Dept. of Ed)
State
Local
Philanthropists
Industry

REASONS TO DOCUMENT THE LANDSCAPE OF CS EDUCATION IN YOUR STATE

Of course, there are a myriad of reasons for state teams to consider committing the time and effort to research, develop, and write a landscape report. State teams, individuals, and organizations with whom ECEP has worked have identified one or more of four BPC goals (and associated research questions) that they wished to address:

GOAL 1: DEFINE AND INFORM
What's the current status of equitable CS education in my state? Do I fully understand which students are underserved in CS education pathways? What can the data tell me about who has access to CS education and the systems that support BPC or create barriers to access?

GOAL 2: ADVOCATE AND DISSEMINATE
What data can I use to convince others of the importance of BPC in our state?

GOAL 3: COLLABORATE AND STRATEGIZE
What are our state's goals for BPC? Do we have a diverse team of leaders developing and acting on strategies?

GOAL 4: TRACK AND SUSTAIN
How can our state ensure we are making progress on BPC? How are we preventing unintended consequences in our efforts? Are our strategies maintaining the status quo, or increasing diversity?

Once you define the scope of your overall BPC effort, the audience for your report, and your short- and long-term goals for the data you gather, you will be able to determine which of the four goals and research questions your landscape report will address. It should be added that exploring which data to collect and how best to utilize the data is an iterative process. You will likely embark on multiple phases in your data effort and publish more than one report as you grow your state's BPC effort.

The section that follows provides a closer look at each of the four goals and research questions.

FOUR BPC GOALS TO LEAD YOUR LANDSCAPE REPORT EFFORT

1. DEFINE AND INFORM

What's the current status of equitable CS education in my state?

Using data in service of BPC work will help to inform development of goals and define and prioritize the work that needs to be done to achieve those goals. Early in the state planning process, decision making may be aspirational and based on assumptions. Anchoring decisions to data allows for more directed planning. For example, clearly identifying the schools in which CS is offered, and the demographics of students participating in CS versus the demographics of the school will help define the scope of your work to recruit and retain marginalized students. Similarly, identifying the teachers eligible to teach CS and where they are teaching can illuminate where additional professional development needs to be offered.

COLLABORATE BEFORE MAKING DATA REQUESTS

ECEP recommends that individuals or individual organizations seeking to conduct a data survey at any level first collaborate with other individuals or organizations to prevent overlapping data requests and survey fatigue. Collaborative efforts have been shown to yield more data and have a greater overall impact on state advocacy and reform efforts. In other words, other state and national organizations may already have access to data that would be useful to you (see resources on page 29) or have already conducted surveys of their membership that could potentially be modified to address CS and BPC. Collaboration will also help to ensure that data is interpreted through multiple lenses. Different stakeholders should and will see different trends, which is vital to systemic change efforts.

Developing a landscape of CS education in your state can and should include information beyond student data sets. The resource you develop may also include information such as how education policy, professional development, and curriculum decisions are made in your state. Understanding the role of LEAs, SEAs, and state governmental entities in educational decision-making will help to define strategies and key audiences for your findings. Identifying key government leaders is also good information to gather early on. **Websites, such as the ones listed below, can point you to lists of state leaders who will be instrumental in advancing policy efforts.**

LINKING POLICY, PEOPLE & PRACTICE

The Education Commission of the States resource "50 State Review" includes an overview of educational policy pathways in all 50 states and an accompanying blog, "Who Makes Ed Policy in Your State?".

Other policy resources to reference when linking your data to state strategies:

- National Governors Association
- Council of Chief State School Officers
- State Higher Education Executive Officers
- The National Conference of State Legislatures 2022 state legislative leaders
- https://www.usa.gov/elected-officials

It is critical — yet potentially challenging — to identify what data will be easy to collect versus what data will be most valuable. Starting with the data readily available can give the team a foundation upon which to build and help define at a later point what data is ultimately needed. As mentioned earlier, the development of a landscape report will be an iterative process. You should adapt the resources and suggestions in this toolkit to work for your team and your state's unique needs.

Given that state education agencies vary in their data request process, there is no single procedure team members can apply in the data collection process. However, team members are encouraged to:

- Look for public-facing data on SEA websites. Some SEA websites may provide valuable data, including disaggregated CS student participation and CS teacher characteristics. Check the SEA website for CS data first to avoid requesting data that is already public facing. More detailed data may be needed on CS and student demographics.
- Check the SEA website for data request guidelines and/or online forms. SEA websites may have guidelines and/or online forms to follow when requesting data for research. These guidelines identify what a department requires in a data request and may present differing processes depending upon the entity making the ask (e.g., state agency versus independent researcher), or based on other parameters.
- Be aware that other state-level entities may provide additional valuable data. An SEA may be supported by another state entity in fulfilling data requests. For example, some SEAs have partnerships with university research units (e.g., Michigan Education Research Institute) that may be helpful resources. SEA data staff may be positioned to point you to other reliable data sources.

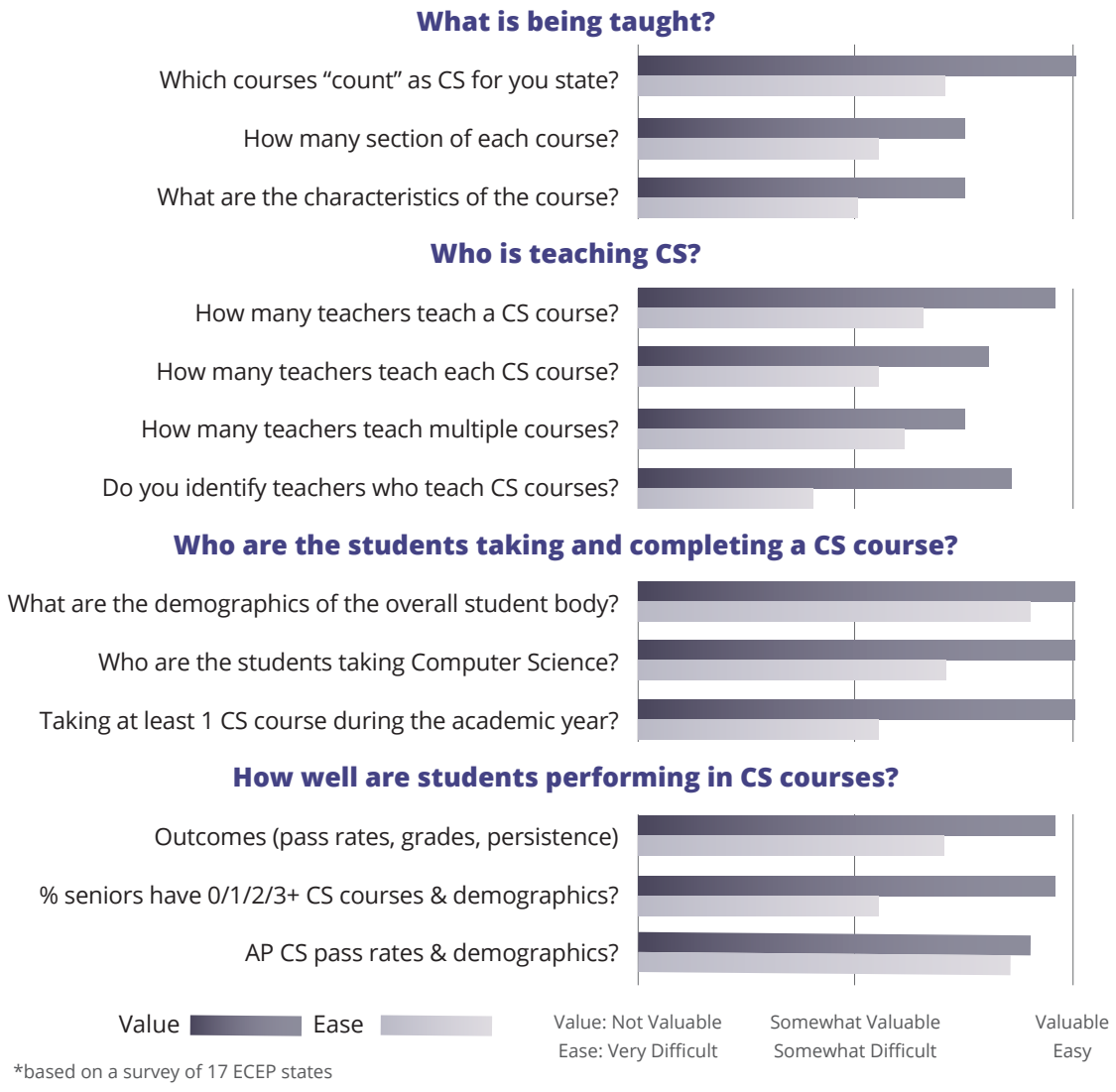
ESTABLISHING COMMON DATA FORMATS CAN HELP

"Everybody does not collect data in the same format or with the same headings. Working with the CS4GA collective and other states like California, we have begun establishing some common data formats for sharing and organization."

— Bryan Cox
Computer Science Specialist
Georgia Department of Education

In 2018, ECEP states were asked to consider what data they had access to, what data they needed access to, and the real and perceived value of the data (e.g. difficult-to-obtain data should only be pursued if it is of high value [BPC data may fall into this category] while data that are easy to obtain are worth collecting even if the perceived value is relatively low). Overall, most data sets were valuable, but varied in how challenging it would be to collect. Try the self-assessment tool at the end of this guide with your team.

EASE AND VALUE OF COLLECTING DATA THROUGH INSTITUTIONAL SYSTEMS AT THE STATE LEVEL (N=17)*



*based on a survey of 17 ECEP states

2. ADVOCATE AND DISSEMINATE

What data can I use to convince others of the importance of broadening participation in computing in our state?

To sell/tell a story, we need numbers and stories. While a lot of anecdotal evidence has directed the CS for All movement across the U.S., anecdotal evidence is no longer a sufficient argument to drive educational policy reform efforts and procure the resources necessary to sustain a movement. In addition, anecdotal evidence can't help your state to establish measurable BPC goals and track progress toward your goals. CS education reform is often pitted against other educational causes, like literacy and math, that are equally important to student success. Having real numbers that define the gap between who is enrolling in CS education, what districts are offering any CS courses and who is being left out of CS pathways will bolster the effectiveness of any CS advocacy work.

It is also important to think at the outset about who you are sharing the data with, and how it will be shared. Sharing data creates transparency, builds trust, and facilitates the strategic planning process. It may also help build a network for stakeholders that support BPC.

> *"The Maryland Center for Computing Education has partnered with the Maryland Longitudinal Data System (MLDS) to create computing education dashboards for all stakeholders, including students and parents, to monitor CS course offerings, determine which students are taking computing courses, and determine which pathways students are taking from high school to college and workforce. Our dashboards provide in-depth information to field stakeholder questions on student CS BPC issues, presenting the need in different ways that will be compelling to different audiences."*
>
> ***Dr. Megean Garvin,*** *Director of Research*
> *Maryland Center for Computing Education*

Data needs to be presented strategically. Although all data should be available to the core team, the data shared with various stakeholder groups should be tailored to message what each stakeholder type needs to know. A state policy maker will look at the data and ask very different questions than a parent of an eighth grader. Before making data requests and publishing a landscape report, state teams should identify their intended audience (or audiences). Based on the projected audiences for the data, make data asks and frame any presentation materials to the needs and interests of specific audiences accordingly. Always develop a clear agenda for a meeting (or meetings), know what your goals are prior to the meeting and consider questions that the audience may have. You may only have one chance to make your case for BPC, so be prepared.

When Massachusetts was rolling out its Digital Learning and Computer Science implementation plan, the state created a rubric to identify stakeholders and potential audiences for the plan. Use the template on page 28 to create your own list of leaders who should be engaged with your CS for all initiative and landscape findings.

In addition, do not assume that all stakeholders have the ability to interpret data the same way that you do. Clarifying to stakeholders the importance of differentiating between percentages of students and the number (or n) of students these percentages reflect, as well as representing a single data set in two ways — for example, data tables paired with pie charts that clearly communicate the "n" for each variable — can make the same data accessible to stakeholders at various levels of acuity in interpreting data. Having team members adept at presenting information both empirically and visually can be a game-changer. Ultimately, your data and the landscape report will need to be packaged in multiple formats to appeal to multiple audiences.

PUBLIC-FACING DATA DASHBOARDS INVITE STAKEHOLDERS TO EXPLORE AND ENGAGE WITH THE REALITIES OF CS EDUCATION

"I get a dozen emails a week that can be greatly diminished if the data was publicly available in a format that is easy to digest. I found myself going to my dashboard every other day to answer someone's question that could have been answered more efficiently with a ***public data dashboard****."*

Bryan Cox, *Computer Science Specialist*
Georgia Department of Education

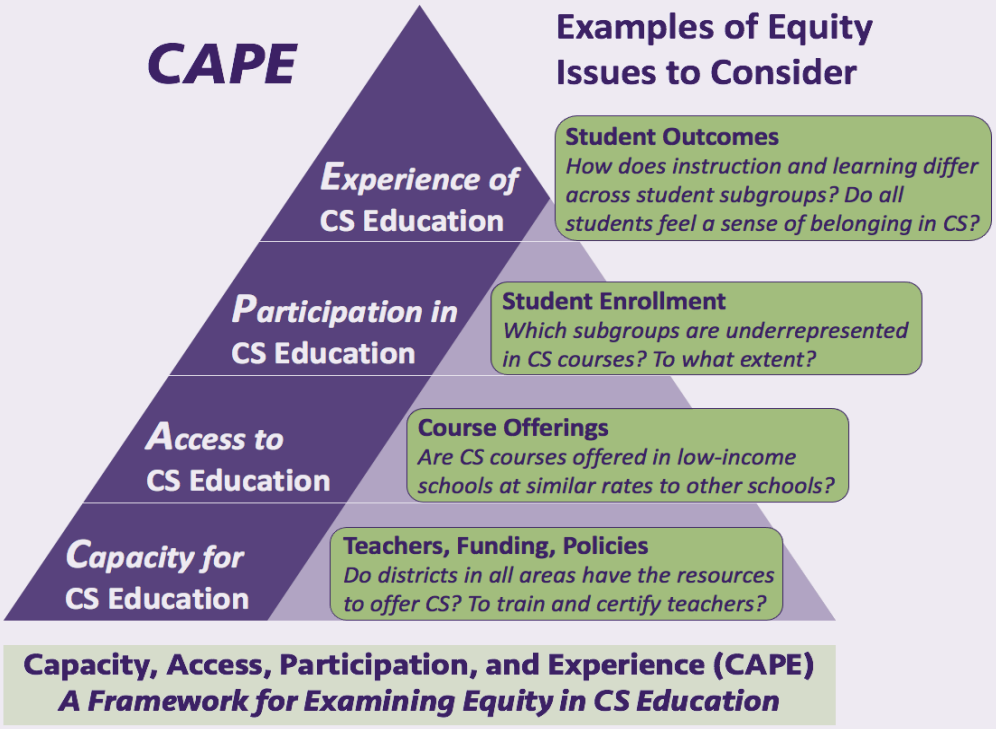
The audience for the findings should be considered at multiple points in the plan for developing and disseminating your landscape report. Your team may decide to embark on a full landscape of CS education across the state or may choose to create smaller reports about specific districts or regions of a state, or different student populations, or for specific stakeholder groups, such as parents and students. Defining the audience will help teams frame the results and build a communication and dissemination plan. Common stakeholders in BPC efforts include policy makers, parents, students, industry leaders, teachers, and school administrators. An intentional process should be created for sharing data, engaging with targeted audiences, and seeking input from these audiences.

Consider the role that you want each audience to play in the overall BPC effort. Understand each audience and individualize presentations to the unique role that each audience plays. Are you seeking engagement from a specific community? Do you want government leaders to engage in CS education policy reform? Are you building a diverse team to develop a BPC strategic plan? Are you seeking partnership and resources from industry leaders? Each group with whom you engage will require a slightly different message.

LEVERAGING THE CAPE FRAMEWORK TO ASSESS EQUITY IN CS EDUCATION

Determining the status of equitable CS education in your state is not a simple matter because educational equity itself is complex and concerns many different aspects of education. Simply measuring and reporting the number of students enrolled in CS courses, for example, only provides one piece of a much larger puzzle. The CAPE framework[4] was developed as a guide for navigating the complexities of assessing equity in CS education. It breaks down areas of assessment into four components or levels: capacity, access, participation, and experience. These four levels are depicted in the figure below. The pyramid structure demonstrates how the four components of the framework are interrelated. Before students can have good experiences learning CS, they must first elect to participate in CS courses. Before students can choose to participate in CS, they must first have equitable access to CS courses. Foundationally, before schools can provide students access to CS, they must first have the capacity to offer CS courses.

The core idea of the framework is that there are issues of equity to address at each of the four levels. Below is a brief description of the four levels of CAPE followed by some examples of approaches to examining equity at each level.



Capacity, Access, Participation, and Experience (CAPE)
A Framework for Examining Equity in CS Education

CAPACITY for CS education refers to the ability of schools and districts to establish and sustain CS programs. This often requires that certain resources (e.g., teachers, funding) are available. Educational policies at the district or state level also play a role, as they may help or hinder the capacity for schools and districts to offer CS courses. It is important to consider whether the capacity for CS education is equitable across your state. For example, do all school districts have adequate funding to establish CS programs, or is that goal beyond the financial capabilities of smaller, rural districts? Similarly, do all districts have the ability to train or recruit new CS teachers?

In developing a state landscape report, equitable capacity can be assessed by examining the distribution of trained and/or certified teachers across schools and districts based on factors such as school location (i.e., rural/urban/suburban) or school demographics (% Free/Reduced Meals, diversity of student body). Are there patterns in how teacher capacity is distributed

[4] Fletcher, C. L., & Warner, J. R. (2021). Cape. Communications of the ACM, 64(2), 23–25

based on these factors? If state CS funding is based on schools or districts applying for grants, how are those grant funds distributed across the state? Who are the "haves" and "have nots" when it comes to funding for CS? Have teachers participated in equity-explicit professional development and if so, how are those teachers distributed across your state?

ACCESS to CS education has to do with students' opportunities to take CS courses and otherwise participate in computing education experiences. When CS is not offered at all schools, it is important to assess whether the schools that do offer CS differ from schools that do not. For example, do schools with CS programs have similar proportions of Black students and Hispanic/Latino students than schools without CS? Do they differ in terms of the proportion of students who are economically disadvantaged or who have limited English proficiency? How does access in rural schools compare to access in urban or suburban schools?

Equity issues in terms of access can and should go deeper than simply comparing schools that do and do not offer CS. For example, the same questions mentioned above can be asked comparing schools that offer more CS courses or advanced CS courses versus those that offer only a few introductory courses. Furthermore, just because a school offers a CS course, that does not mean that all students have the opportunity to take the course. There may be prerequisites or other barriers to enrolling in CS courses that disproportionately impact some students more than others. For example, do schools limit access to CS courses by requiring students to complete Algebra I before they can enroll in CS? If so, are there historical disparities in early Algebra enrollment that effectively limit access to CS for some students?

PARTICIPATION in CS education means students enrolling in CS courses and programs when they have the opportunity to do so. Even if students have equitable access to CS, there remains the possibility for inequities in course enrollment. It is important to examine, for example, enrollment rates across different subgroups of students. Identifying disparities in enrollment rates should then spur further investigation into the reasons behind the differences. The messaging that students receive about CS course opportunities, student and parent perceptions of CS courses, recruitment strategies (or lack thereof), and the scheduling of CS course sections at times that may compete with courses from other disciplines are just some of the many factors that may influence a student's decision to enroll in CS.

Landscape reports should explore equitable participation across several dimensions. Are there enrollment disparities based on factors such as gender, race/ethnicity, socio economic status, student disability, or a combination of these factors? Are CS course enrollments representative of the student population in a school, district, or state? Do the demographics of advanced CS courses differ from those of introductory CS courses? Are there discrepancies in enrollment vs. completion based on demographics?

EXPERIENCE of CS education has to do with the many different types of outcomes that stem from participating in opportunities to learn CS. The equity-minded questions to ask here are myriad. For example, are all students benefiting from their participation in CS learning opportunities to the same extent? Are there disparities between different subgroups of students in terms of the quality of instruction they receive or the messages they receive about their potential future in CS? Are all students getting the same level of rigor for equivalent courses, and do they receive the support they need to meet that rigor and succeed? Are student learning outcomes (such as AP exam performance) consistent across various demographic groups?

Equitable student learning experiences can be measured quantitatively by examining student grades, test performance, and degrees or certificates achieved. However, these types of student outcomes are all a function of many qualitative aspects of learning that are not so easily measured at scale. Do all students, regardless of demographics, feel like they "belong" in a CS classroom? Some indirect ways of measuring equitable student experience in CS classrooms in your state could include an analysis of course curricula. Do curricula explicitly address issues of equity and inclusion?

3. COLLABORATE AND STRATEGIZE

What is our state's goal for BPC?

Advancing K-16 computer science education while ensuring that pathways and strategies are designed to increase diversity at all levels requires collaboration among many partners and goals that are both grounded in data and aspirational. The process of collecting data, compiling the data into manageable and meaningful materials, and then discussing the findings allows state teams to make decisions about sustainable strategies.

Involving a diverse group of stakeholders at all stages of data collection, interpretation and dissemination will support an inclusive process that is reflective of broadening participation and equity work. Initial insights and assumptions about the landscape of CS education from teams of invested collaborators will inform the development of initial research questions. Teachers from across a given state will have some sense of what professional development is available to them, and what curricula are being used or discussed in K-12 classrooms, whereas researchers may struggle to find this information in a timely manner. Postsecondary faculty and administrators will have some awareness of teacher preparation programs and CS degree paths or will know who to approach about gathering the needed data.

Engaging a diverse group of stakeholders will also enhance your ability to combine data to determine whether students are introductory or emergent CS learners and draw conclusions from combined data points. Beyond assessing whether students are taking a CS course, an analysis of combined data can answer questions regarding whether students are progressing in or completing a CS pathway, are prepared for success in an Advanced Placement or dual credit CS course and are taking and successfully completing those courses. Analyzing disaggregated and intersectional combined data is also critical.

Lastly, consider that you, your team, and/or your stakeholders may not have the capacity to work toward all the BPC goals you have in mind at the outset, or that emerge after you collect and analyze your data. If team or stakeholder capacity may be an issue, plan strategically. **Consider critical stages of the work — what must be done in Year 1 to lay the groundwork for Year 3, which in turn lays the groundwork for Year 5.**

4. TRACK AND SUSTAIN

How can our state ensure we are making progress on BPC?

A strong system for tracking BPC within a state can provide a roadmap for change. Individual data elements and full landscape reports create a baseline of knowledge about the state of CS education in K-16. This knowledge, commonly highlighting both disparities and strengths, is compelling to the leaders who can influence CS education pathways from the classroom to the statehouse, and (potentially) everything in between.

Data requests and state strategies should be focused on the goal of broadening participation in computing. Be aware if a project starts to drift toward an access discussion vs. explicitly identifying how students' race, ethnicity, gender, ability, LGBTQ+ identity, and socioeconomic status impact their experience in computing pathways. Once initial data has been collected, a baseline should be established that will inform equity-explicit BPC strategies. Goals should be set to address those strategies. The CAPE Framework can support this work. Metrics for measuring progress within strategies will help teams stay on track, adjust strategies, amplify successes, and observe progress on identified goals. Creating a landscape report should launch an iterative process, allowing for revisions, new directions, and new considerations for what data is relevant to BPC.

What did I do with this data? I put it all together in a report that I gave to our state legislators who supported, approved, and funded our CS Education grant so that they could see where we were BEFORE the dollars were awarded to where we were ONE YEAR into the grant award. I will be doing the same thing for this current year, and every year after to demonstrate the need and value-added results to continued funding."

Cindi Chang, *EPP over Computer Science and STEM, Nevada Department of Education*

"Often the data we needed to create a well-informed landscape report was simply not available. We acknowledged this issue in our report rather than skip important pieces of the landscape, and now the issue of data collection and sharing is a priority area for our state CS initiative."

Dave Frye, *former Associate Director, The Friday Institute for Educational Innovation, College of Education, North Carolina State University*

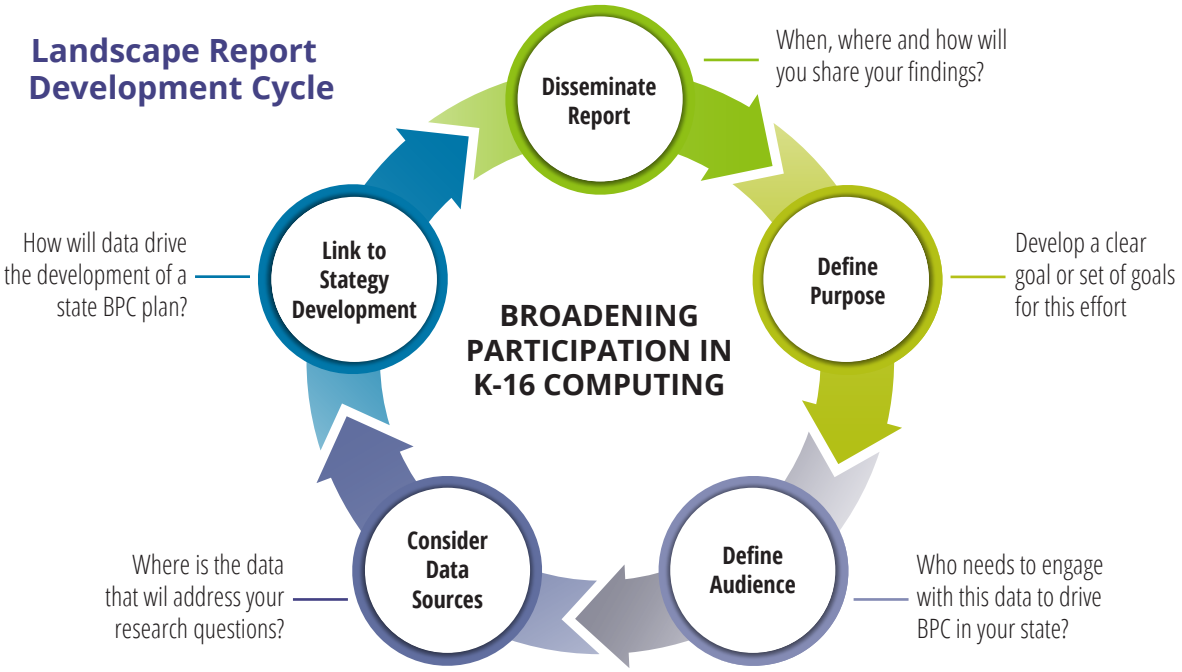
Collecting data will be a generative process. As more information is gathered, it will most likely raise more questions. Multiple states have revised their initial landscape work, either reframing their initial inquiry or revising goals and strategies based on progress. Computer science is a rapidly changing field. While education is not known for rapid evolution, it is natural that CS education efforts will need to be responsive to change, making a tracking system even more valuable. A tracking system will build confidence in strategies and allow teams to reflect on and revise short-, mid- and long-term goals.

WHERE DO WE START?

This is one of the most common questions state teams ask in launching BPC efforts. The figure below shows common stages in the life cycle of the development of a landscape report. Note that this is not a linear process but is intentionally designed as a continuous cycle.

We've outlined common landscape themes, potential partners that can support a landscape report, and state and national databases for locating the data you will need to build the landscape of CS education in your state. If you are not currently working with your SEA, your first step should be to discuss your interest in conducting a landscape report process with leaders in the SEA. The SEA will have access to the best data available and should be involved in any capacity building conversations to improve data availability and use.

The Ease/Value self-assessment, located at the end of this document, can help your team identify what data is easy to start with and which data points will require some capacity building.



WHO CAN GUIDE THIS WORK?

Defining the state of CS education in K-16 pathways, reviewing state education policy, and identifying leaders in government, industry and education can be a daunting task. In general, the reports that we are discussing are on a large scale, designed to inform a whole state and potentially provide input relevant to the national BPC and CS for all movements. We recommend that any leadership group seeking to conduct a landscape report form a small team to carry out the work.

We caution against placing sole responsibility for a landscape report upon a single individual — such as a SEA staff person or postsecondary faculty member — who is internal to the system they are attempting to influence and who is juggling many other responsibilities. Such an approach will likely draw out the data collection and analysis phase and may not yield the best result. In some instances, an individual external to a state agency — a university-embedded researcher with a team of graduate students, or consultant — may be best-positioned to convene and/or lead a team to develop a landscape report. An individual — again, potentially but not exclusively a university-embedded researcher — with substantive experience using state and federal data sets will provide valuable expertise on where to locate which data elements, and how to frame the data request to receive the information you need.

> *"By having this 'data story,' we have been able to demonstrate to our university's education programs (and engineering programs) that this is a viable movement toward computer science education at the K-12 level that will have impact at the higher education level in a very short time, and not just a passing fancy. Data analysis and evaluation, aggregated to tell a story, moves mountains."*
>
> ***Cindi Chang,*** *EPP over Computer Science and STEM, Nevada Department of Education*

WHAT QUESTIONS AND THEMES SHOULD WE ADDRESS?

This is not intended to be an exhaustive list. Some of the items are aspirational, and some of the items overlap in different sections.

CONTEXT

DEFINING COMPUTING EDUCATION AND BROADENING PARTICIPATION:

- Does the state have a common definition of CS education?
- If your state doesn't have a common definition, how will you define what courses "count" as computer science?
- Does the state have clear BPC goals? Have diversity and equity goals been set in other STEM-related fields?
- Does your state have specifically identified marginalized populations in your state toward whom you're directing your BPC efforts?
  a. How have these populations been identified?
  b. What datasets determined that these populations of students are marginalized in CS?
  c. What systems are creating barriers to equitable CS education?

STATE EDUCATION AGENCY: INVESTMENT AND POLICIES:

- Do you have someone in your Department of Education who is responsible for work on CS education?
- How has your state Department of Education helped move CS education forward?
- What CS education data is currently tracked by your SEA or individual schools and districts? How can you access this data?
  - Advanced Placement (AP) data — Where is AP offered? Who is enrolled? What are pass rates?
  - How does your team define CS education? This is important for the next step of identifying which courses will be relevant (for example a course with programming versus typing)
  - What are the course codes for the classes that meet the definition of CS? (business applications, digital literacy, AP courses)
    - Is there a CS/IT student requirement at the state level?
  - How does your state define high-quality or advanced vs. introductory CS?
  - How does your state track CS in Career and Technical Education schools?
  - Can state data systems track participation in CS at the K-8 level?
    - If so, can participation be broken down to document student demographics?
  - Does your state have CS standards?

- Is there adequate CS teacher certification/endorsement in the state?
  - Do teachers need to be certified to teach CS?
- What kind of teacher professional development is available?
- What other National Science Foundation investments in computing education have been made in the state?
- Are funds available to support CS PD or to increase the enrollment of CS (e.g., Perkins Funds, etc.)?

PARTNERSHIPS, COLLABORATORS, SUPPORT ORGANIZATIONS:

- What organizations and/or committees are working toward broadening participation in computing and CS for all?
- What kind of CS surveying is already being done?
- Are there partnerships that already exist between CS advocacy organizations and your state?
  - CSforALL
  - CSTA Chapters
  - Code.org regional partners
  - Project Lead The Way (PLTW)
  - College Board
  - ECEP
- What can you learn from other states?

GOVERNMENT:

- What are the current policies concerning CS education at various levels of government?
  - Policies may include: standards; curriculum; credit for graduation or college admissions; teacher credentials/licensure; state funding earmarked for CS education
- Who are the people in positions of influence within the state at various levels of government that care about CS education?
  - Identify current leadership, their role in education, CS education, and their potential for being a champion for CS education. Who are the decision makers? Who are the potential influencers?
- What government agencies are working on CS education initiatives?
  - IT initiatives? Tech access? CS and IT industry issues?
- Using Code.org's 9 policy ideas for making CS education fundamental, where are the gaps in your state? Which areas are important for your state context?

CAREER/INDUSTRY:

- What major businesses/industries exist in your state and would be considered stakeholders?
  - Tech, banking, healthcare, cyber security, etc.
- What major businesses/industries in the state are reporting job gaps?
  - What would they require of an incoming graduate?
  - Do they offer an intern program?
- Have they historically offered funding (or matched funding) to support educational initiatives?
- How have various industries collaborated with educational reform efforts in the past?
- What are the workforce needs? What are the projected needs over the next 10 years?
  - Describe economic/workforce environment

- Workforce demand for computing skills
- IT sector
- Other sectors
- Project job growth
- Vacancies
- Economic opportunities
- Gap between college graduates/industry-based certifications and job openings

K-12 EDUCATION

Access to courses:

- What CS offerings are currently available to K-12 students? (consider formal and informal)
  - What formal K-12 classes exist? What are the standards for these courses?
  - If standards don't exist, what learning objectives guide the courses?
  - At what grade levels is CS being taught?
  - To what extent is integrated computational thinking being used in K-8 classes?
  - How is it measured?
- Which schools offer computing education?
  - Which types of schools (consider vocational-technical, comprehensive, charter, public, private)?
    - In which districts (consider geography, rural, urban, suburban)?
  - What curriculum is being used?
    - How is the curriculum vetted?
  - How do they fund these offerings?
  - Who makes the decisions to offer these classes?

Student Participation:

- Which students participate in CS education? (include demographics: gender, race/ethnicity, ELLs, etc.)
  - Which students are successful in CS education courses? (include demographics: gender, race/ethnicity, ELLs, etc.)
  - Which of these students participate in a pathway of CS courses?
  - Is K-8 CS knowledge measured? If so, is there equity across the state?

Teacher Preparation:

- Who is teaching CS (consider educators, their license, preparation, gender, race/ethnicity, years of experience)?
- What training is required for teachers?
  - Are training programs high quality and aligned to state standards or the national framework?
- What teachers are eligible to offer CS education?
- What teacher education programs are available for pre-service teachers?
  - Where are these programs offered?
  - What is the enrollment?
    - What are the demographics of these teachers?
  - How many teachers complete these programs?
  - Is it sufficient to fuel a pipeline of teachers for your state?

K-12 to College Pathways:

- What pathways exist for high school graduates who seek to continue CS education in two- and four-year colleges?
- Does your state have statewide course-related admissions requirements for public four-year institutions? If so, to what extent can any computer science courses fulfill math, science or foreign language admissions requirements? And how broadly accessible are those courses in high schools statewide?
- Does your state offer dual enrollment?
  - Where is it available?
  - Which students (demographics) participate?

HIGHER EDUCATION

Computing Majors:

- What CS courses and programs are offered in your state and private two- and four-year colleges?
- What is the CS enrollment rate in private, public and community colleges?
  - What is the race, class, gender of the students?
  - What degree programs are available?
    - Where?
    - What are the enrollments in these programs, over time?
    - Who completes these programs? (look across as many years as possible)
    - What is the capacity of the degree programs?

Non-majors

- How is CS available for non-majors?
- Are there unique initiatives at the state and private two- and four-year colleges for bringing computing into non-computing majors?
- Meeting demand
  - If there is significant investment in computing education at the K-12 level, what will the impact be on higher education?
  - Which institutions of higher education in your state offer pre-service CS teacher training?

    If none, which are best poised to potentially offer it?

Two-, Four-year pathways

- How many students transfer from two-year colleges to four-year institutions in computing majors?
  - What are the demographics of these students?
    - How well are these students retained in the computing major?
  - What transfer policies are in place to facilitate the transfer of CS majors?

Dual Credit

- What dual credit opportunities or programs exist in CS?
- Are there specific higher ed institutions or K-12/higher ed partnerships that could serve as models for dual credit?

HOW SHOULD THE REPORT BE FORMATTED?

As discussed in the sections about the audience for the data and dissemination of data or a full report, the format should meet the needs of the audience. Be sure to include visuals — infographics work great for this! An accompanying slide deck with data and key report takeaways that stakeholders could use to amplify the impact and reach of your report is particularly valuable.

"Data access is the first step. It's important to understand who has the data and how readily it is available. The most important lesson I've learned, however, is having the right data available at the right time in a digestible format for the given audience. This is critical in moving conversations along in the moment rather than having to 'get back' to someone with numbers later."

Bryan Cox, *Computer Science Specialist, Georgia Department of Education*

DESIGN FOR A FULL REPORT:

COVER PAGE:
A clear title, names of authors, welcoming graphics, and date of publication will make the report easy to identify. Include a recommended citation for easy reference.

TABLE OF CONTENTS:
A report can range between 10 and 70 pages. A TOC can help readers quickly locate the sections they want to review.

EXECUTIVE SUMMARY:
In one to two pages, provide readers with a brief overview of the relevant findings. The CT report does an excellent job pointing readers to findings that will drive state efforts.

OVERVIEW OR CONTEXT:
Provide readers with key details about the reason for writing the report, the goal for the report moving forward, and information about any BPC efforts, strategies or related meetings that are aligned with the report. This section may also contain a call to action, allowing readers the opportunity to learn about and join the BPC effort.

CONTENT:
Content should be a blend of detailed charts and tables with an accompanying narrative that makes the material accessible to the reader. Content may be divided by grade band (elementary, middle, high school, college), policy issues (standards, Code.org's 9 policy categories), K-16 to career pathways, or employment projections.

CONCLUSION AND RECOMMENDATIONS:
Report writers should put initial findings in front of diverse audiences of stakeholders to collect feedback on the results. Capturing feedback, and reviewing the data with stakeholders, will help writers develop recommendations. This section may include suggestions for strategic planning, policy reforms, future data requests, or provide the reader with a summary of the findings and how they pertain to BPC.

KEY DISSEMINATION FORMATS

Digital Materials

Having a digital landing space for your data will allow more people to gain access to your findings. You can point specific audiences to a full report or break down your data into tools and resources for specific audiences. Developing slide decks that can be tailored to specific groups is a great way to ensure that the data is being used to build your BPC efforts. The easier you make it to share materials and build commitment, the more likely it is that your data will not collect dust.

Printed Materials

A one-page overview, complete with easy-to-read charts can quickly point an audience to important data. If people leave with flyers and mini-reports, they will have a reference source to continue to tell the story of BPC.

Presentations

In-person and virtual presentations of data findings serve two main purposes. The first purpose is to engage a diverse group of stakeholders in a conversation about the state of CS education in your state. Presentations allow for feedback and offer the chance to develop a common message about the goals of any BPC effort, or steps being taken toward the development of an effort. The second purpose of a presentation is to build a common message, making sure that a consistent conversation is happening across an entire state. Unified messages and collaborative policy efforts will support sustainable advocacy efforts.

Media Releases

Local news outlets and social media can drive significant attention to the story you are building about the state of CS education in your state. If you are writing a press release, work with key leaders to get a quote about their interest in the data and commitment to increasing diversity in CS education pathways. Any media release or social media posts should be used to build engagement in your message, amplify success, and engage more people in CS education advocacy.

> *"The data points you highlight as callouts, images, or infographics will be the only thing remembered by many. They will become others' talking points and shape many conversations around CS Education."*
>
> ***Cindi Chang,*** *EPP over Computer Science and STEM, Nevada Department of Education*

DATA SOURCES

Several sources of publicly available (Table 1) data can establish the computing education context in a state, including the workforce demand, secondary and higher education availability and participation, teacher PD needs, and general state policies. This data is often exceedingly detailed, minimally linked to systemic issues to be addressed in BPC efforts or has a "lag" but is readily available.

Many states find the need to create surveys (see examples in the appendix) to complete a full landscape report. For example, some states have administered surveys to teachers who offer computing courses to better understand their background, the courses being offered, professional development needs, their perceptions of student experiences in the classroom, and/or perceived barriers to broadening participation. Gathering new data is useful but time-consuming and difficult to get an accurate representation of the state. Making a data request through the state department of education for specific data concerning courses available, students, and teachers may be the most efficient method for collecting state-specific data. Best practice is to combine data available via state departments of education with data captured in specialized surveys.

> *The first few data pulls I made, I didn't know what I was looking for. Course numbers, demographic info, longitudinal data, AP and other assessment data all sent me back to make redundant data pulls. Every time someone asked me a new question, I was enlightened but forced to make redundant data pulls. I'm still adding new fields as more questions come but I'm developing a consistent data question to pull data with. I also didn't understand enrollment cycles and when was the best time to make a data request. For instance, it doesn't do any good to request data until all districts have submitted their data for the year.*
>
> ***Bryan Cox,*** *Computer Science Specialist, Georgia Department of Education*

When state team members reach out to an SEA to submit a data request, it is recommended that team members first review public-facing data already available on the SEA website. SEA website home pages typically have a link to "data" or "reporting" or something under a state-specific proprietary name (e.g., SchoolView on the Colorado Department of Education website). Team members may also find CS-specific data posted separately on the CS page of the SEA website (e.g., Washington's SEA links to its legislatively-mandated CS data summary report on the agency's CS page).

If public-facing data are unavailable, team members should check the data division section of the SEA website for data request guidelines and/or online forms. Data division webpages or data request forms will often include contact information for SEA staff team members whom you may reach out to with follow-up questions. Data request processes differ by state. Some SEAs may require a separate data request to be submitted for teacher data and student data; others may establish different processes for external researchers, as opposed to researchers employed by state agencies. The next section has more details and links for accessing and utilizing public datasets.

TABLE 1: PUBLICLY AVAILABLE DATA SOURCES

RESOURCE	WHAT IT INCLUDES
Workforce related	
Rebooting the Pathway to Success Preparing Students for Computing Workforce Needs in the United States (2014)[1]	A report detailing total employment in computing; average annual salaries in computing; graduation requirement; Advanced Placement exams; post-secondary certificates and degrees awarded.
U.S. Bureau of Labor Statistics [2]	Detailed workforce information, by state
http://www.projectionscentral.com/Projections/LongTerm [3]	Detailed occupational projections through 2026; can be broken down by state
Center for Education and the Workforce [4]	Analysis of state-based administrative data; national datasets, such as the American Community Survey; and new sources of labor market data, such as internet job postings collected by private research firms.
Teacher Certification, preparation, and attitudes	
National Survey of Science and Mathematics Education [5]	A survey report of teacher backgrounds and beliefs; science, mathematics, and computer science professional development; science, mathematics, and computer science courses; instructional objectives and activities; instructional resources; and factors affecting instruction.
CS as High School Graduation Requirements	
Computer Science in High School Graduation Requirements [6]	This Education Trends report identifies states that allow or require districts to apply computer science coursework toward completion of high school graduation requirements in math, science or foreign language.
K-12 School Institutional characteristics	
NCES Elementary/Secondary information System [7]	The National Center for Education Statistics hosts a "table generator" that can be used to query information about institutional and school characteristics of K-12 schools (this can be done on an individual school, state or national level). A large array of data are available, including fine-grained information about gender/race/ethnicity by grade level. Data are available for both public and private institutions, though the public school data are considerably more consistent and robust.
Stanford Education Data Archive (SEDA)	SEDA includes a range of detailed data on educational conditions, contexts, and outcomes in schools and school districts across the United States. It includes data at a range of institutional and geographic levels of aggregation, including schools, districts, counties, commuting zones, metropolitan areas, and states. It includes measures of academic achievement, achievement gaps, school and neighborhood racial and socioeconomic composition, school and neighborhood racial and socioeconomic segregation patterns, and other features of the schooling system.
Map of schools offering CS [8]	A crowdsourced map of the U.S. showing schools that are believed to offer CS as well as those areas where opportunities are limited or non-existent.
AP Participation	
College board AP data [9]	AP data by state

Career and Technical Education	
Career and technical education, [10]	nonprofit representing State Directors and state leaders responsible for CTE (formerly known as National Association of State Directors of CTE Consortium-NASDCTEc.)
Perkins V [11]	Each state's Perkins V state plans, accountability, and enrollment reports.
Higher Education	
IPEDS data center.[12]	The Integrated Postsecondary Education Data System is a system maintained by the National Center for Education Statistics. It can be used to query information on graduates in a specific field based on CIP codes (CIP code 11 is Computer and Information Sciences and Support Services). Information can be queried at the institution, state and national level (as well as other geographic distinctions). The most recent final-release data typically include the time period up to 2 years ago. Data can be parsed by gender as well as race/ethnicity.
Computing Research Association [13]	Survey reports and data for enrollment, production, demographics, and employment of Ph.Ds. in computer science, computer engineering, and information programs. It is the trusted source for data regarding masters and undergraduate enrollment and degree production, as well as salary and demographic data for faculty.
State Policies and Context	
US Census Bureau [14]	Access data through products and tools including data visualizations, mobile apps, interactive web apps and other software concerning a range of economic and social indicators.
Education Commission of the States [15]	Education Commission of the States tracks state education policy on a wide variety of education topics
Governors for CS [16]	Governors that have committed to supporting statewide CS education
State facts [17]	Infographic about the CS policies in each state
NSF fastlane [18]	Awards made by NSF can be searched by region and topic
NSF Award Summary [19]	A database of aggregated information about the level of NSF funding at the state and national level as well as an option to look at the individual awards within a single state

URL for cited sources

1. https://pathways.acm.org/ACM_pathways_report.pdf
2. https://www.bls.gov/
3. http://www.projectionscentral.com/Projections/LongTerm
4. https://cew.georgetown.edu/state-researchhttps://cew.georgetown.edu/state-research/
5. http://horizon-research.com/NSSME/2018-nssme/research-products/reports/technical-report
6. http://www.ecs.org/wp-content/uploads/09.13.2016_Computer-Science-in-High-School-Graduation-Requirements.pdf
7. https://nces.ed.gov/ccd/elsi/tableGenerator.aspx
8. https://code.org/yourschool
9. https://research.collegeboard.org/programs/ap/data/archived/ap-2017
10. https://careertech.org/cte-your-state
11. http://cte.ed.gov/grants/state-profiles
12. https://nces.ed.gov/ipeds/use-the-data
13. https://cra.org/data/
14. https://data.census.gov/cedsci/
15. https://www.ecs.org/
16. https://www.governorsforcs.org/governors
17. https://code.org/promote
18. https://www.nsf.gov/awardsearch/advancedSearch.jsp
19. https://dellweb.bfa.nsf.gov/awdlst2/default.asp

TEMPLATE: STAKEHOLDER/AUDIENCE PROFILE

Who Who are the stakeholders that you will share your landscape report with? Who do you seek to involve in broadening participation in computing work?	**Power Player(s)** Name specific leaders or organizations that can be instrumental in broadening participation in computing. Time spent planning who to disseminate your findings will help you refine your message and requests of their time and effort.	**How** How do members (individuals, institutions, or communities) usually consume information? Be specific, consider the cultures of the organizations you are seeking to reach. Educators and Administrators have a very different culture than leaders in tech industries.
1. Parents, guardians, and caregivers (+ parent organizations within their schools)		
2. State and local Policymakers		
3. School administration		
4. Teachers		
5. Guidance Counselors		
6. Students		
7. Researchers and Higher Education		
8. Business		
9. Community Based Organizations and Non-profits		
10. News Media		
11. Other:		
12. Other:		

MASSACHUSETTS DEPARTMENT OF ELEMENTARY AND SECONDARY EDUCATION

This template was developed by the Massachusetts Department of Education.

EASE & VALUE SURVEY TOOL

EASE / VALUE SURVEY Overview: This template is designed to help your landscape report team consider the ease of collecting a set of specific data in support of your state's BPC goals, and the value of this data. These tables do not ask you to collect the data; however they will help you frame a data request and develop your overall landscape report strategy. The context questions on pages 19 - 22 can also be considered in the ease/value frame.

Many of the ECEP states have developed strategic plans for organizing and advancing equitable CS education in their states, taking into account the unique context of geography, educational standards, teacher certification, pathways and other factors that influence CS education. Collecting statewide data is challenging. State teams are sometimes using informal channels to make data requests, are gathering data in a piecemeal manner, or are finding that the systems available are highly controlled and inaccessible. The ease/value framework will assist you in building your timeline for data collection, consider which data will provide the most relevant context for equity-specific initiatives, and help to identify gaps in capacity in the landscape report process.

The basic request includes five questions, each with sub questions that allow for the capture of BPC as defined by the state. The five driving questions are:

1. What CS courses are being taught?
2. Where is CS being taught?
3. Who is teaching CS?
4. Who are (and are not) the students completing a CS course?
5. How well do students perform in CS courses?

Each of these questions may be answered at the:

- Individual level (which may be an individual course, an individual teacher, or an individual student);
- School level, in which data are aggregated across the school;
- District level, in which data are aggregated across a district;
- State level, in which data are available at the state level.

The template asks for an Ease and Value score for each potential level of data collection. Adding additional notes under each question will help you track additional questions you discover about the data, or data systems.

Created in collaboration with SageFox Consulting.

For each subset of questions, we ask **"Ability to disaggregate the data in support of the above questions."** In order to fully define the need for equitable computing in K-12 it is imperative that data is disaggregated. Researchers and advocates should look at data for each of the sub questions by students overall AND by:

- Gender
- Race
- Ethnicity
- Economic disadvantage
- Disability status
- English Language Learners (ELL)

Scale:

Ease:

3 = gathering this information is easy for our state team
EX: State has an identified leader who has consistent access to data sources

2 = gathering this information is somewhat difficult/ complex for our state team
Data is collected based on relationships and not formal pathways

1 = gathering this information is very difficult/complex for our state team
We know what we need to collect but do not have access

0 = I don't know

Value:

3 = this information is highly valuable to our state team

2 = this information is somewhat valuable to our state team

1 = this information is not valuable to our state team

0 = I don't know

STATE DATA COLLECTION TEMPLATE

Core questions	Sub-questions & Data Categories	Ease	Value
What is being taught?	Which courses "count" as computing for your state?		
	How many sections of each course are held?		
	Which grade band(s) is a course included in?		
	Which non-CS courses have computing integrated into them?		
	Which courses are part of a CS pathway?		
	Which courses count as dual enrollment?		
	Is there a way to determine if a specific offering is of "high quality"?		
	Do you have the ability to disaggregate the data in support of the above questions?		
Notes			

Ease:
3 = Defining this information is easy for our state team
2 = Defining this information is somewhat difficult/complex for our state team
1 = Defining this information is very difficult/complex for our state team
0 = I don't know

Value:
3 = This information is highly valuable to our state team
2 = This information is somewhat valuable to our state team
1 = This information is not valuable to our state team
0 = I don't know

Core questions	Sub-questions & Data Categories	Ease	Value
Where is computing taught? [Access]	Total number of public high schools in state		
	Total number of public high schools that offer computing		
	Number of high schools that offer multiple computing courses		
	Total number of public K-8 schools that offer discrete computing courses		
	Total number of public K-8 schools that offer integrated computing courses		
	Number of public K-8 schools that offer multiple computing courses		
	Ability to disaggregate the data in support of the above questions		
Notes			

Ease:
3 = Defining this information is easy for our state team
2 = Defining this information is somewhat difficult/complex for our state team
1 = Defining this information is very difficult/complex for our state team
0 = I don't know

Value:
3 = This information is highly valuable to our state team
2 = This information is somewhat valuable to our state team
1 = This information is not valuable to our state team
0 = I don't know

Core questions	Sub-questions & Data Categories	Ease	Value
Who is teaching/can teach computing? [Capacity]	How many educators teach a computing course?		
	How many educators teach each computing course?		
	How many educators teach multiple computing courses?		
	Educator training / PD history		
	Educator certification/credentialing		
	Educator primary teaching field		
	Educator # years teaching K-12		
	Educator # of years teaching computing		
	Ability to disaggregate the data in support of the above questions		
Notes			

Ease:
3 = Defining this information is easy for our state team
2 = Defining this information is somewhat difficult/complex for our state team
1 = Defining this information is very difficult/complex for our state team
0 = I don't know

Value:
3 = This information is highly valuable to our state team
2 = This information is somewhat valuable to our state team
1 = This information is not valuable to our state team
0 = I don't know

Core questions	Sub-questions & Data Categories	Ease	Value
Who are (and are not) the students taking a computing course? [Participation]	Overall number of students What are the demographics of the overall student population? 1. Gender, ethnicity, race, language, SES, free/reduced lunch, disability		
	Number of students taking computing (by course) Who are the students taking Computer Science (by course)? 1. How many students 2. Demographics: Gender, ethnicity, race, language, SES, free/reduced lunch, disability		
	# students taking at least 1 computing course in academic year (K-8) How many students? 1. What are the demographics of these students? 2. What is the pass rate/demographics of these students?		
	# students taking at least 1 computing course in academic year (9-12)		
	# High school grads who have taken at least 1 computing course		
	Ability to disaggregate the data in support of the above questions		
Notes			

Ease:
3 = Defining this information is easy for our state team
2 = Defining this information is somewhat difficult/complex for our state team
1 = Defining this information is very difficult/complex for our state team
0 = I don't know

Value:
3 = This information is highly valuable to our state team
2 = This information is somewhat valuable to our state team
1 = This information is not valuable to our state team
0 = I don't know

Core questions	Sub-questions & Data Categories	Ease	Value
How well do students perform in computing courses? [Experience]	Computing course pass rates (K-8)		
	Computing course pass rates (9-12)		
	Computing course grades (K-8)		
	For high school graduates, the number of computing courses taken across their years in school.		
	How many students are enrolled in AP CSP and AP CS-A courses **at the school / district level?**		
	How many students received HS credit for AP CSP and AP CS-A courses (not exams) **at the school / district level?**		
	Ability to disaggregate the data in support of the above questions		
Notes			

Ease:
3 = Defining this information is easy for our state team
2 = Defining this information is somewhat difficult/complex for our state team
1 = Defining this information is very difficult/complex for our state team
0 = I don't know

Value:
3 = This information is highly valuable to our state team
2 = This information is somewhat valuable to our state team
1 = This information is not valuable to our state team
0 = I don't know

LANDSCAPE WORKSHEET

1 Building a team

List 3 -5 people, roles, or organizations that you have or need to bring to your team to revise or develop your landscape report. How will they support data gathering, data analysis, data reporting, and data utilization?

1.
2.
3.
4.
5.

Other notes:

2 What stage are you in?

What efforts have been made to advance equitable CS in your state? What aspects of ECEP's 5-Stage model have been attempted? Where does the landscape report—or where do other data efforts—fit in your overall state strategies?

3 CAPE Framework

What are your state's greatest challenges related to Capacity, Access, Participation, and Experience? How are you measuring these/how do you know? How is data providing evidence or direction?

Process 4

LANDSCAPE WORKSHEET *page 2*

1 Building a team

2 What stage are you in?

3 CAPE Framework

Additional Actions

4

5

6

Process 4

LANDSCAPE WORKSHEET *page 3*

Notes

Questions

Other