The purpose of our upcoming landscape report (Spring 2021) is to examine the landscape of K-16 computer science education in Minnesota. It will be the first statewide report focused on computer science, and will share key data within the context of our state’s K-12 schools and higher education institutions. In order to preview the report and ignite conversation, shorter briefs will be released during Fall 2020, with the complete report published in Spring 2021. This is the first brief.

What is Computer Science?
Computer science (CS) is fundamental to our society, from the algorithms that determine social media feeds to the technology powering our elections.

Computer science is defined as “the study of computers and algorithmic processes, including their principles, their hardware and software designs, their implementation, and their impact on society” (Tucker et. al, 2003, p. 6).

This definition anchors the K-12 Computer Science Framework and Computer Science Teachers Association (CSTA) K-12 CS Standards, which guide many other state’s policies related to K-12 computer science education. The K-12 Computer Science Framework “promotes a vision in which all students critically engage in computer science issues; approach problems in innovative ways; and create computational artifacts with a practical, personal, or societal intent” (2016, p. 1-2).

Computer science moves beyond everyday use of computers and digital citizenship skills and instead builds on these skills in order to help people create rather than consume technology. Computer science is a literacy that promotes problem solving, creativity, communication, collaboration, and other skills students need to participate in today’s world (Guzdial, 2019; Scharber et al., 2021, Vee, 2018).

Why Should Everyone Learn CS?
In 2016, the Obama Administration brought together various groups to codify Computer Science for All as a national movement to “empower all American students from kindergarten through high school to learn computer science and be equipped with the computational thinking skills they need…to be active citizens in our technology-driven world” (Smith, 2016). (Cont. on page 2)
“CS is a ‘new basic’ skill necessary for economic opportunity and social mobility.” (Smith, 2016)

(Cont. from page 1) This initiative led to a conscious awareness of the need for incorporating computer science within K-12 education, catalyzing multiple national organizations [Expanding Computing Education Pathways Alliance (ECEP), Code.org, the Computer Science Teachers Association (CSTA), and CSforALL], to coalesce around a common mission: increasing and broadening participation in CS.

There are many reasons why all K-12 students should learn computer science: equity and social justice; competencies and literacies; citizenship and civic engagement; technological, social and scientific innovation; economic and workforce development; school reform and improvement; and personal agency, joy, fulfillment (Vogel et al, 2017). It is important for local stakeholders “to deliberate about why they think CS education is important, then use these answers to guide their choices around designing and making available CS learning opportunities” (Santo, Vogel, & Ching, 2019, p. 5). Notably, in the U.S., it is at the state level where education policies and practices are enacted.

Additionally, Ko and her colleagues remind us that “computing does not occur in a vacuum: it shapes and is shaped by ever-evolving social, cultural, institutional, and political forces” (Ko et al., 2020, p. 31). Therefore it is imperative “that all people - not just computer science majors - understand that creating with software comes with collective responsibilities to society” (Ko et al., 2020, p. 33).

Equitable participation in K-16 computer science education is an unmet goal around the country, even as it is increasingly acknowledged as imperative in both formal and informal learning settings (Ozturk et al., 2018). Groups historically underrepresented in computing include women, Black, Indigenous, and Hispanic people, as well as people with disabilities, from low-socioeconomic backgrounds, and located in rural areas. Broadening the participation of students in computing from K-12 to post-secondary education and on to computing careers will support diverse perspectives and more innovation in the technology we use everyday. Technology is not neutral; the people who create and build with technology infuse their biases in their designs and code.

The briefs and the upcoming report examine equity through Minnesota’s capacity for, access to, participation in, and experience of K-16 computer education (Fletcher & Warner, 2020). Currently, not all Minnesota students have access to or participate in CS learning opportunities, and we will illustrate existing equity issues and opportunity gaps in our state in order to better understand areas for improvement.

Looking Forward

The next briefs and report will provide overviews of the state’s K-16 computer science participation, K-12 computer science teacher preparation, computer science pathways in higher education, workforce, and industry, and a list of resources.

These briefs and, ultimately, our report are a call to action for policy makers, education leaders, school board members, educators, principals, industry leadership, higher education faculty, families, and other stakeholders in Minnesota to engage in conversations about prioritizing state-level computer science education opportunities, pathways, and policies in order to address equity issues in our state.

References:
Minnesota Data at a Glance

There are a number of factors and realities that impact the state’s ability to offer equitable K-16 computer science education that are connected to histories of persistent educational achievement gaps for Black, Hispanic, and Indigenous students; growing immigrant communities (half a million in 2020); differences in socioeconomic statuses, and economic and cultural differences between urban and rural areas in the state. These contextual realities are not the only reasons why Minnesota’s CS education offerings are limited, but they must be considered as reasons why opportunities and access for all K-16 students to computer science is important.

According to the most recent 2020 State of CS Education report, 47% of high schools in the U.S. teach computer science; however, in Minnesota only 19% of high schools teach computer science, which is last in the nation.⁶ (Note: about half of Minnesota school districts report data to the Minnesota Department of Education on courses and enrollments.)

Through the advocacy efforts of national organizations, many states have adopted policies that support increased access to and participation in K-16 computer science. Code.org outlines nine recommended policies, and they are one indicator or measure of progress in K-12 computer science education.

Of Code.org’s nine recommended CS policies⁶, Idaho, Utah, Arkansas, and Maryland have adopted all of them. Minnesota has currently enacted two policies: allowing CS to satisfy a core graduation requirement (#8) and establishing a dedicated CS position in our state education agency (#6).

Student Enrollment in K-12 Minnesota Schools (2019-2020)³

<table>
<thead>
<tr>
<th>Student Group</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian</td>
<td>1.7%</td>
</tr>
<tr>
<td>Asian</td>
<td>6.9%</td>
</tr>
<tr>
<td>Black</td>
<td>11.3%</td>
</tr>
<tr>
<td>Hawaiian or Pacific Islander</td>
<td>0.1%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>9.9%</td>
</tr>
<tr>
<td>White</td>
<td>64.8%</td>
</tr>
<tr>
<td>Two or More Races</td>
<td>5.4%</td>
</tr>
<tr>
<td>Free or Reduced Meals Eligible</td>
<td>35.8%</td>
</tr>
<tr>
<td>Special Education Services</td>
<td>16.7%</td>
</tr>
<tr>
<td>English Learner</td>
<td>8.6%</td>
</tr>
<tr>
<td>Experiencing Homelessness</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

93% all
84% rural

Statewide Household Broadband Access⁴

Graduating on Time⁵
83.7% all students
88.7% white, non-Hispanic
72.8% students of color

12,078 open computing jobs each month⁶

How Does Minnesota Compare to Other States?

According to the most recent 2020 State of CS Education report, 47% of high schools in the U.S. teach computer science; however, in Minnesota only 19% of high schools teach computer science, which is last in the nation.⁶ (Note: about half of Minnesota school districts report data to the Minnesota Department of Education on courses and enrollments.)

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5 Minnesota Compass (n.d.). High School Graduation. https://www.mncompass.org/education/high-school-graduation#1-6081-g