K-12 Computer Science: A Foundation for Cybersecurity Talent

Julia Wynn, *Code.org*
Vic Drier, *SciMathMN and Project Lead The Way*
John Bartucz, *University of Minnesota, formerly Rochester Public Schools*

Agenda

- The What and Why of Computer Science
- CS and the Cyber Workforce
- Landscape of CS Access in Minnesota
- Cybersecurity Instruction in Minnesota
- Aligning Curriculum to Industry: A Model

The What and Why of Computer Science

The Fundamentals of Computer Science

Computing systems

Networks & the Internet

Creating

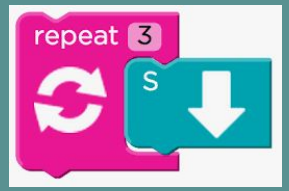
Data & Analysis

Algorithms & Programming

Impacts of Computing

The Fundamentals of Computer Science

Elementary



Middle

High School

Why CS is Important

Teaches necessary digital literacy and computing skills for the modern era

Provides a foundation for AI literacy

Supports other learning

Creates a pipeline to fill workforce gaps in in-demand jobs, including cybersecurity

Cybersecurity Concepts in CS

Computational Thinking & Problem-Solving

Data & Analysis

- ⟹ Protecting data

Algorithms and Programming

- ⟹ Secure networks, encryption, software development

The Internet & Online Security

- ⟹ Cryptography, threats, authentication, secure networks

Impacts of Computing (& technology on students' lives)

- ⟹ Social networking, cyber-bullying, mobile computing


Computer Science
Cyber-
security

State Cybersecurity/CS Curriculum Highlight: North Dakota & Kentucky

In 2019, North Dakota became the first state to adopt K–12 Computer Science and Cybersecurity Standards, embedding cybersecurity knowledge and skills across all grades and strands in the standards.

Example Foundational CS Course w/ Cybersecurity Focus (KY)

Cyber Literacy 1	Cyber Literacy I is a hands-on course that builds a strong cyber foundation for high school students. The course introduces students to cyber by blending robotics, programming, electricity, and elements of liberal arts. Students learn about the opportunities, threats, responsibilities, and legal constraints associated with operative in cyberspace. Throughout the course, students learn the basics of electricity, programming, and networking as well as develop critical thinking skills. Cyber Literacy I lays a foundation for further exploration into STEM and cyber-related topics. Students spend at least 20 hours programming and applying learned concepts through programming. Programming is defined, by the K-12 CS Framework, as the craft of analyzing problems and designing, writing, testing, and maintaining programs to solve them.

CS and the Cyber Workforce

Why CS is Important: The Cyber Workforce

National Need

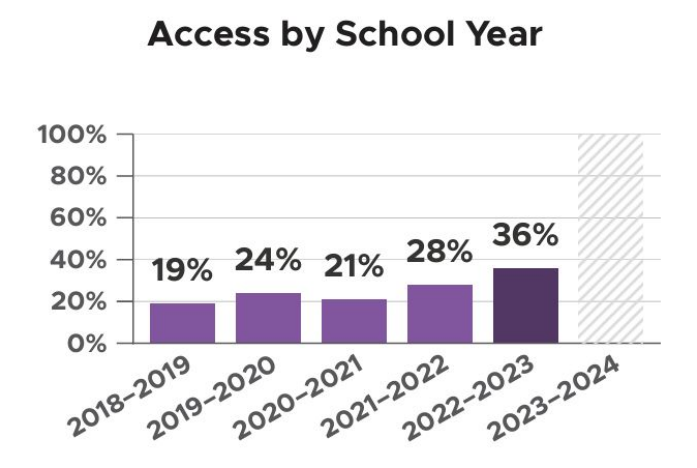
- There are 600,000 unfilled cybersecurity jobs in the U.S
- In 2023, America's cyber workforce gap grew 17.6 percent year over year — or by about 480,000 positions
- Software developer is projected to be the 2nd highest growth job over the next 9 years

State Need

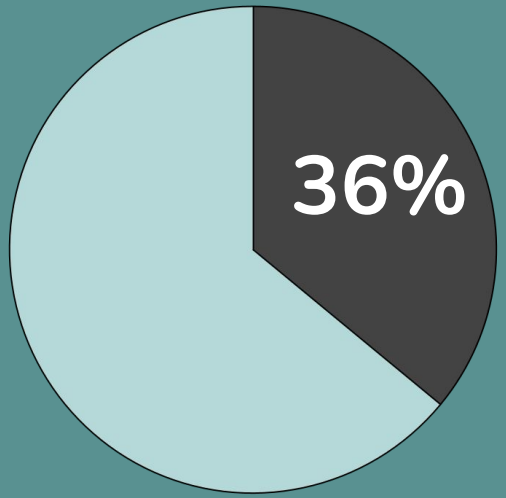
- 37,945 unique tech job postings over the last year in Minnesota
- 18,044 tech establishments in Minnesota
- Tech companies account for nearly 10% of Minneapolis' workforce

Landscape of CS Access in Minnesota

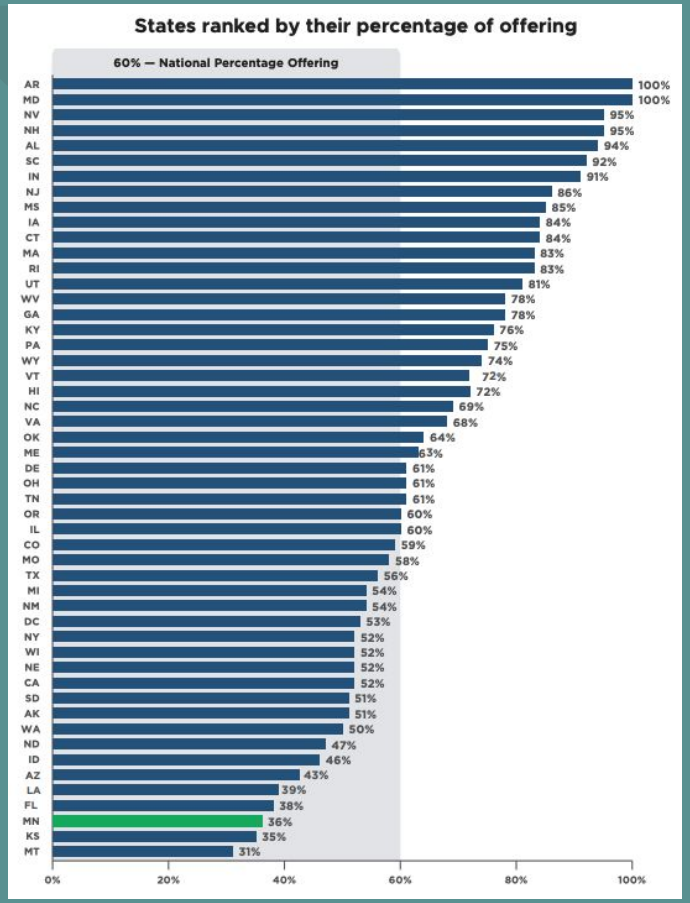
MN State Landscape on CS Access

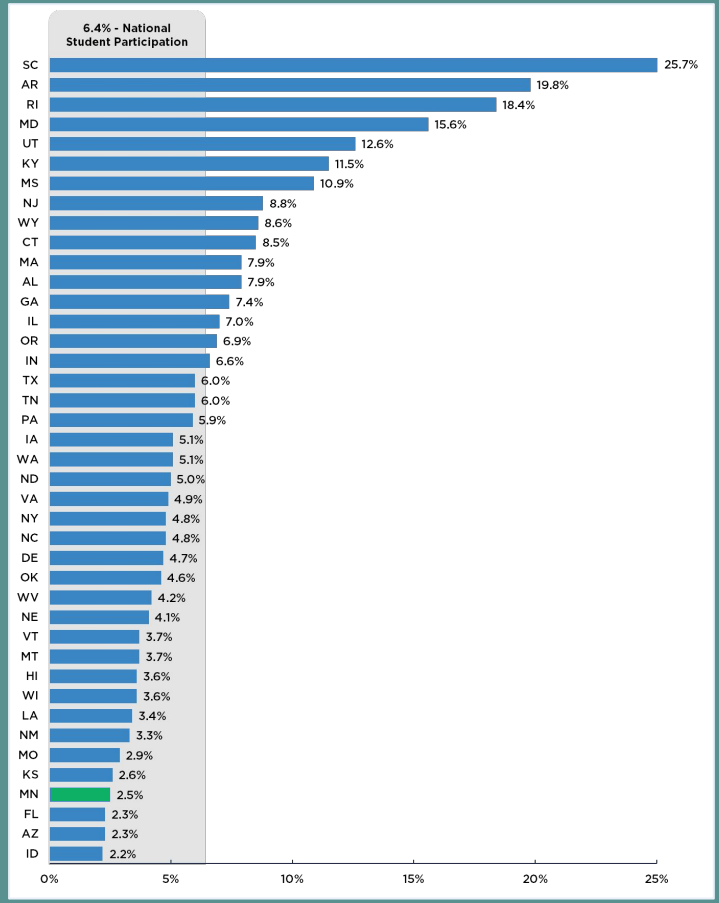


High Schools Offering CS



National Ranking: Access and Participation





State Plan For CS - Policy Recommendations

1. **CS Advisory Committee -** create a dedicated group to work with MDE to inform and support implementation of the Strategic Plan
2. **Teacher Qualification and Licensure -** create multiple qualification and licensure pathways for CS educators
3. **Grants and Funding -** fund LEA grants for technology infrastructure and implementation of district CS plans
4. **K-12 CS Pathway -** develop K-8 CS standards to integrate CS into elementary schools and require a middle school course; also ensure high schools offer computer science electives
5. **Continuous Improvement Structures -** create enhanced data and reporting structures and an evaluation process and revision cycle for the implementation of CS in schools
6. **Awareness Building -** work with regional partners to keep audiences informed about ongoing Plan work
7. **LEA CS Education Plans -** require each LEA to create a local plan for providing CS to their students
8. **Outside CS Funding -** consider outside sources of funding, such as local industry, to support implementation
9. **Regional Communities of Learning -** create region-based communities of learning to provide support to LEAs in identifying relevant community needs, developing education plans and securing funding
10. **Graduation Requirement Review -** establish a committee to holistically review graduation requirements with the aim of potentially adjusting requirements to encompass computer science in the future

2025 CSforAll-MN Coalition Policy Priorities

K-12 CS Pathway

1) In 2026, create a Computer Science Standards Committee to develop CS standards for K-8 grades ($116,000 in FY27).
2) Require every high school to offer a CS elective.

LEA Funding

1) Allocate $15,000 to each LEA ($7.5M total) to create a plan for CS Education by the end of FY27.
2) Allocate $1 million per year to MDE for competitive grants for LEAs to implement CS education plans in FY26 and FY27.

Teacher Qualification and Licensure

Allocate $500,000 per year to PELSB to provide incentives for teachers to earn a license in computer science and provide competitive grants to establish licensure programs in computer science.

Advisory Committee

Establish an ongoing Advisory Committee to work with MDE to inform and support the implementation of the state plan, including creating resources and building awareness in Minnesota communities ($500,000 per year).

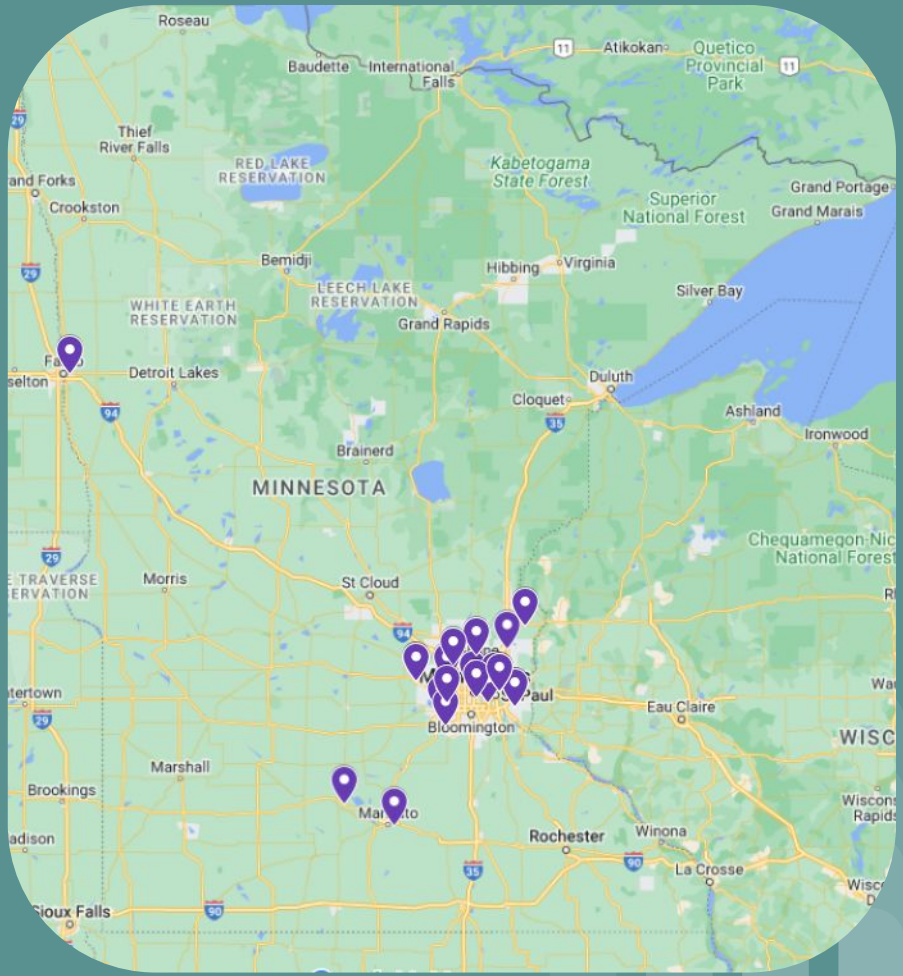
Where do CS teachers come from?

- Approximately 40 colleges with PELSB-approved programs
  - They will need standards (and demand) to create programs
  - Difficult to compete with industry for CS majors
- Alternate pathways:
  - Grandfather-in existing CS teachers
  - Content Area Endorsements (PELSB)
  - **Industry Expertise**

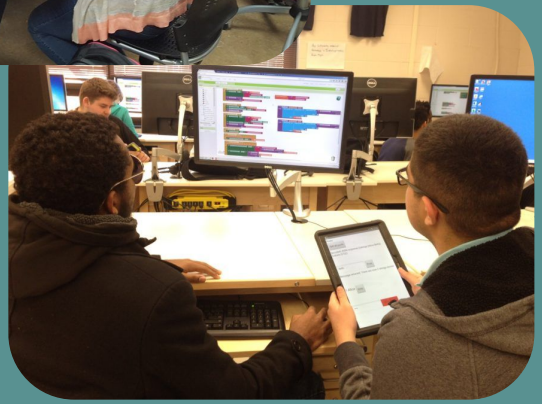
Cybersecurity Instruction in Minnesota

Cybersecurity Instruction in Minnesota

- 36% of Minnesota High schools offer Computer Science (Code.org)
- 21/1244 Minnesota High Schools 1.6% offer cybersecurity (PLTW.org)
- 48% of High School Cyber students report this is the first CS class they have taken (2023)



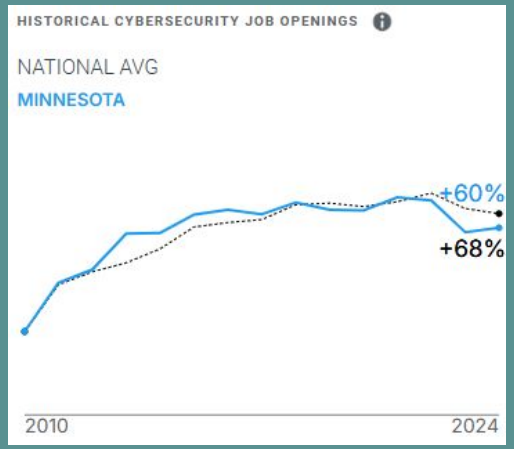
What it looks like in schools, what schools are doing to connect CS to cyber, projects, connections to industry



- Addressing Cybersecurity Challenges: Explores real-world cybersecurity threats and vulnerabilities.
- Hands-On Learning: Develops practical skills through virtual lab simulations.
- Protecting Digital Privacy: Learns techniques to safeguard personal information in a connected world.
- Securing Critical Infrastructure: Understands the importance of securing vital systems and networks.
- Ethical Hacking: Cultivates a mindset of responsible security practices.

Current Needs and Trends

- 16,927 Total MN Workforce
- 5,682 Cyber Openings
- Increase in Cyber openings even during tech contraction



cyberseek.org

Introduction and Sector Overview

Technology careers play an essential role in sustaining Minnesota businesses. Tech Industries rely in particularon Tech Talent, contributing $37.5 billion to Minnesota's GDP in 2023.

111,540

Tech Jobs Held by Professionals in Minnesota

3.6%

Of all Employment in Minnesota is in Tech Occupations

37,945

Unique Tech Job Postings Over the Last 12 Months in Minnesota, representing 6% of all job postings (down -15% from the prior 12-month period)

18,044

Tech Business Establishments in Minnesota (firms with payroll)

MN Tech Association

Aligning Curriculum to Industry: A Model

CTECH

CAREER AND TECHNICAL EDUCATION CENTER AT HEINTZ

CTECH - a unique model, but one we can learn from

- Began with "IT Launch" and "AP Computer Science"
- Not everyone wants to be an F1 driver
- No existing Cybersecurity and IT Support K12 curricula in 2016
- Local business donated 30 decommissioned desktops
- Extremely supportive school district and business IT staff
- Originally Modified Professional Training:
  - CompTIA A+ (Exam and industry certification)
  - SANS Institute "Cyber Aces"
  - University-level Intro to UNIX
- More recently:
  - CompTIA Authorized Partner
  - Cisco Networking Academy