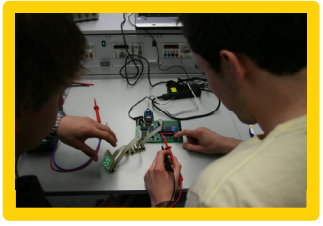

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# Michigan K-12 Computer Science Standards

Public Information Session

February 2, 2019

Library of Michigan and Historical Center

Lansing, Michigan

# Agenda

- Introduction – Sli.do audience participation
- What is computer science
- Urgency and Equity
  - Perspective from Andrew Spiece, Microsoft Philanthropies
- Standards Overview
- Computer Science Implementation
  - Mary Wever, Waverly Middle School
  - Cecelia M. Anderson, East Lansing High School
- Question and Answer Segment – Sli.do

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# Sli.do

- Connect to WiFi – MHC-Public (no password needed)
- Open browser on your phone and type in sli.do
- Type in U294 and press return or enter
- We will now activate the poll – what is your role
- As the presentation continues,
  - Type in your question (name is optional) and press send
  - Vote on questions you like to bring them up to the top of the queue
  - We also have notecards for those who would like to use them

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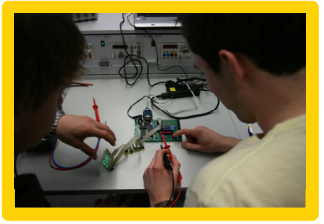

# What is Computer Science?

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# Computer Science Is Changing Everything


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# Computer Science is:

- a theory and practice that allows you to program a computing device to do what you want it to
- a tool that helps to tell a story or make something happen with technology
- a discipline that emphasizes persistence in problem solving — a skill that is applicable across disciplines, driving job growth and innovation across all sectors of the workforce
- a skill that teaches students how to use computers to create, not just consume

# Computer Science is **not**:

- learning how to type or use a mouse
- learning to use word processing, spreadsheet, or presentation software (e.g., Word, PowerPoint, Google Docs & Drive)
- learning how to build or repair computers
- playing video games
- skills to facilitate online assessment taking

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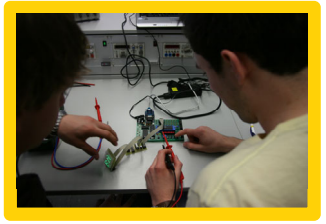

# Urgency and Equity: Setting the Stage

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# Urgency

| Michigan High-Demand, High-Wage Careers | Projected Annual Job Openings | Hourly Wage Range | Job Growth from 2016 to 2026 | Typical Education and Training* |
|---|---|---|---|---|
| Computer and Information System Managers | 830 | $46-$73 | 12.3% | Bachelor's degree, plus work experience |
| Computer Systems Analysts | 1,200 | $31-$49 | 8.5% | Bachelor's degree |
| Computer User Support Specialists | 1,790 | $17-$29 | 11.0% | Some college, no degree |
| Software Developers, Applications | 2,160 | $33-$53 | 31.0% | Bachelor's degree |
| Software Developers, Systems Software | 1,000 | $33-$52 | 15.2% | Bachelor's degree |

Source: Bureau of Labor Market Information and Strategic Initiatives

# National Outlook

- Computer and information technology occupations are projected to grow 13% from 2016 to 2026
- Growth is faster than the average for all occupations
- Approximately 557,100 new jobs will be added
- Demand will stem from greater emphasis on cloud computing, collection and storage of big data, and data security
- Median annual wage was $84,580 in May 2017, higher than median annual wage for all occupations of $37,690

Based on Bureau of Labor Statistics Data, Occupational Outlook Handbook

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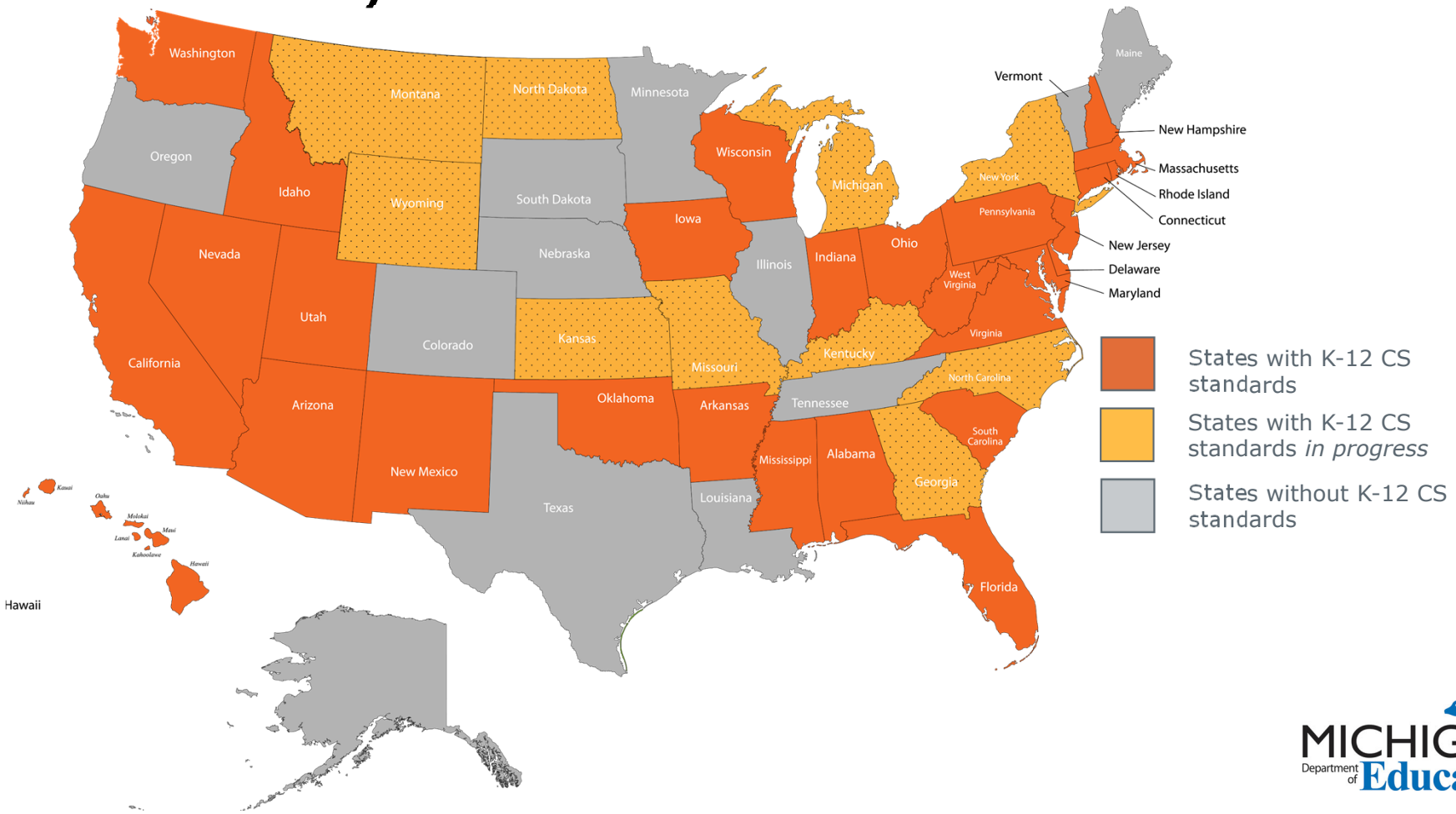
# Computer Science Standards Adoption Nationally

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# Computer Science and Other Career Pathways

- Computer science foundation will equip students with ability to explore other interests
- Succeed in any career they choose
- Use computer science skills to solve problems and be productive citizens
- Apply computational thinking to all industries

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# Equity

- Computer science learning opportunities are not widely available for *all* learners and teachers
  - 90% of students and parents agree that people who work in computer science have the opportunity to work on fun and exciting projects and make things that help improve lives (Google & Gallup, 2015)
  - Most Americans believe computer science is as important to learn as reading, writing, and mathematics (Horizon Media, 2015)
- An analysis of 2015 National Assessment of Educational Progress (NAEP) survey showed that only 44% of 12th graders attend high schools that offer any computer science courses (Change the Equation, 2016)
  - Students with the least access are Native American, African American, and Latino, from lower income backgrounds, and rural areas

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# AP Computer Science

Only 153* schools in Michigan – 23% of Michigan schools with AP programs – offered an AP Computer Science course in 2017-2018

2,931 AP computer science exams taken in 2018:

- 26% were female
- 114 were taken by Hispanic or Latino
- 71 were taken by black
- 5 were taken by American Indian/Alaska Native
- 2 exams were taken by Native Hawaiian/Pacific Islander

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# AP Course Correlation with a Greater Likeliness for Post-Secondary Pursuit

All students are *SIX TIMES* more likely to major in computer science than students who did not take AP CS

Female students are *TEN TIMES* more likely to major in computer science than students who did not take AP CS

African American students are *SEVEN TIMES* more likely to major in computer science than students who did not take AP CS

Hispanic/Latino students are *EIGHT and a HALF TIMES* more likely to major in computer science than students who did not take AP CS

*Based on national data available from Code.org*

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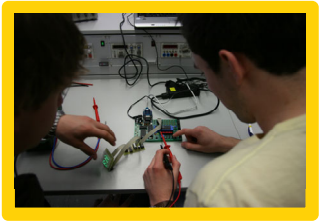

# Urgency and Equity: Business and Industry Perspective

Andrew Spiece

Microsoft Philanthropies

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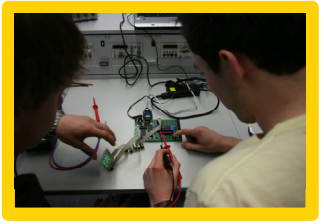

# Standards Overview

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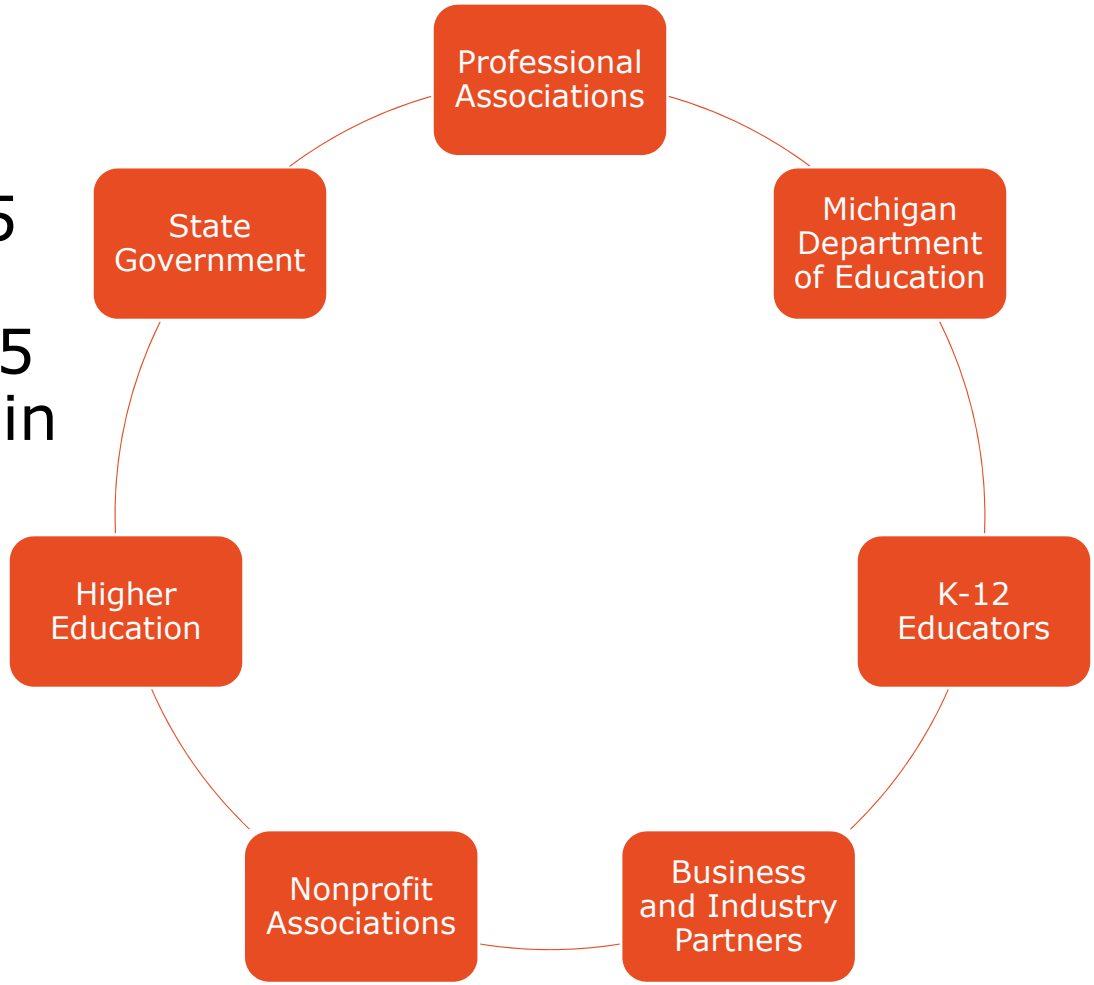
# Process

- Brought together 45 individuals representing over 35 stakeholder groups in May 2018
- Convened seven in-person meetings

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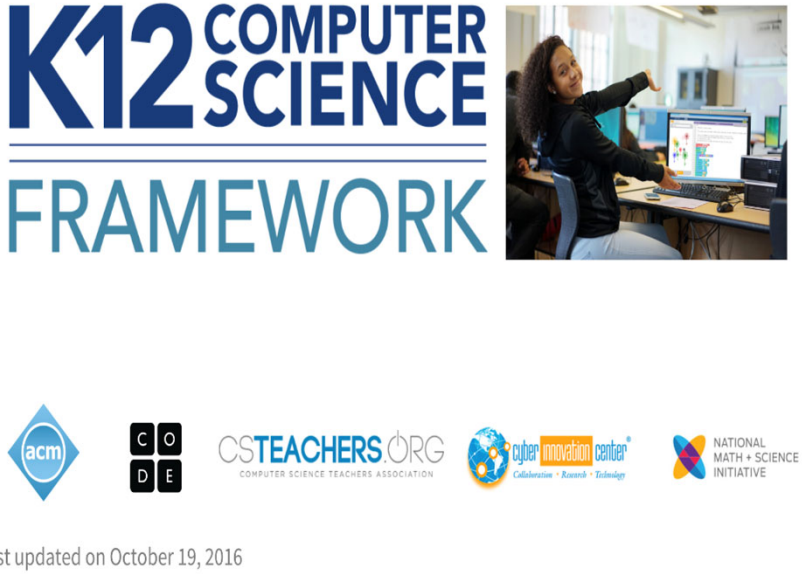
# Agreed Upon Foundation

- Build upon K-12 Computer Science Framework which provides
  - Overarching, high-level guidance per grade bands
  - One primary input for standards development

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# Guiding Principles

- Ensure that all students and teachers have equitable access to and participation in computer science
- Focus on essential standards that allow for expansion within context
- Use research and best practice to drive development and implementation
- Align to nationally-recognized standards and frameworks
- Enable teachers to implement the curriculum in ways that engage and inspire students and support the learning

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# Agreed Upon Foundation

- Computer Science Teachers Association (CSTA) Standards
  - Delineate a core set of learning objectives designed to provide the foundation for a complete computer science foundation grades K-12
  - Provide detailed, measurable student performance expectations


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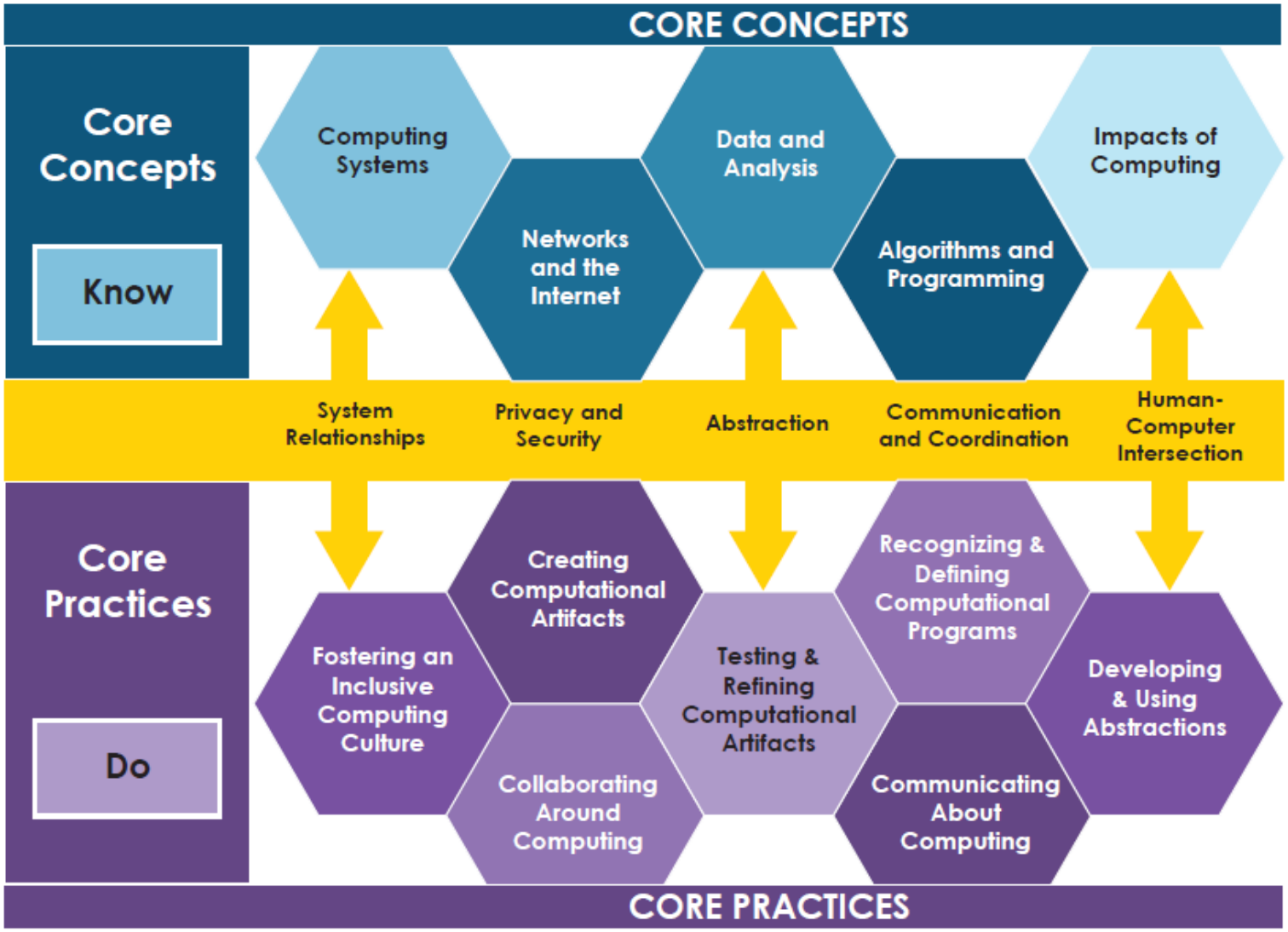


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# Core Concepts

- Computing Systems
- Networks and the Internet
- Data and Analysis
- Algorithms and Programming
- Impacts of Computing

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# Computing Systems

- **Devices** – many everyday objects contain computational components. Students learn about connected systems
- **Hardware and Software** – Computing systems use hardware and software to communicate and process information in digital form
- **Troubleshooting** – When computing systems do not work as intended, troubleshooting strategies help people solve the problem

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# Networks and the Internet

- **Network Communication and Organization** – Computing devices communicate with each other across networks to share information
- **Cybersecurity** – Transmitting information securely across networks requires appropriate protection

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# Data and Analysis

- **Collection** – Data is collected with both computational and noncomputational tools and process
- **Storage** – Core functions of computers are storing, representing, and retrieving data
- **Visualization and Transformation** – Data is transformed throughout the process of collection, digital representation, and analysis
- **Inference and Models** – Computer science and science use data to make inferences, theories, or predictions based upon data collected from users or simulations

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# Algorithms and Programming

- **Algorithms** – Sequence of steps designed to accomplish a specific task
- **Variables** – A symbolic name used to keep track of a value that can change while a program is running
- **Control** – The use of elements of programming code to direct which actions take place and the order in which they do
- **Modularity** – Characteristic of a software/web application that have been divided (decomposed) into smaller modules
- **Program Development** – A set of instructions a computer executes to achieve a particular objective, developed through a design process

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# Impacts of Computing

- **Culture** – Computing culture – including belief systems, language, relationships, technology, and institutions – and culture shapes how people engage with and access computing
- **Social Interactions** – Computing can support new ways of connecting people, communicating information, and expressing ideas
- **Safety, Law, and Ethics** – Legal and ethical considerations of using computing devices influence behaviors that can affect the safety and security of individuals and society

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# Core Practices

1. Fostering an Inclusive Computing Culture
2. Collaborating Around Computing
3. Recognizing and Defining Computational Programs
4. Developing and Using Abstractions
5. Creating Computational Artifacts
6. Testing and Refining Computational Artifacts
7. Communicating About Computing

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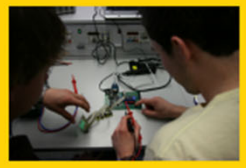

# DRAFT

## Michigan K-12 Standards
## Computer Science

January 2019

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## STANDARDS BACKGROUND AND ORGANIZATION

### CONNECTION TO THE K-12 COMPUTER SCIENCE FRAMEWORK

When the Michigan CS Standards stakeholder group began the process of considering the need for standards for students in Michigan, it studied the K-12 Computer Science Framework (k12cs.org) developed by a cross-sector team that convened for similar purpose. The CS Framework has been taken up by other states across the nation as a reliable, representative compilation of the concepts and practices encompassed by the computer science field. After reviewing the CS Framework and talking with national experts involved in its development, the Michigan stakeholders determined that the CS Framework would serve as a foundation to Michigan CS Standards.

### CONNECTION TO THE CSTA K-12 COMPUTER SCIENCE STANDARDS

Built upon the K-12 Computer Science Framework, a set of standards were created by the Computer Science Teachers Association, which have served as a model for adoption by other states. After studying models from other states, engaging in conversation among the experts in computer science, K-12 and high education, government, business, and industry, the Michigan stakeholder group unanimously supported the recommendation to adopt the CSTA Standards for Michigan.

### THE CSTA STANDARDS:

- Introduce the fundamental concepts of computer science to all students, beginning at the elementary school level.
- Present computer science at the secondary school level in a way that can fulfill a computer science, math, or science graduation credit.
- Encourage schools to offer additional secondary-level computer science courses that will allow interested students to study facets of computer science in more depth and prepare them for entry into the work force or college.
- Increase the availability of rigorous computer science for all students, especially those who are members of underrepresented groups.

The standards have been written by educators to be coherent and comprehensible to teachers, administrators, and policy makers.

### SECTION LABELING / CODING

Levels 1A, 1B, 2, and 3A are the computer science standards for ALL students. The Level 3B standards are intended for students who wish to pursue the study of computer science in high school beyond what is required for all students (specialty or elective courses.

Coding for each section references back to the Concepts and Practices of the K-12 CS Framework and is illustrated below:

| Identifier | Standard | Subconcept | Practice |
|---|---|---|---|
| 1A-CS-01 | Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use. | Devices | 1.1 |
| 1A-CS-02 | Use appropriate terminology in identifying and describing the function of common physical components of computing systems (hardware). | Hardware & Software | 7.2 |
| 1A-CS-03 | Describe basic hardware and software problems using accurate terminology. | Troubleshooting | 6.2, 7.2 |

# Standards Adoption for Michigan

| Level | Label | Grade Span | Details |
|---|---|---|---|
| 1A | Lower Elementary | K - 2 | CS standards for ALL students |
| 1B | Upper Elementary | 3 - 5 | |
| 2 | Middle School | 6 - 8 | |
| 3A | High School | 9 - 10 | |
| 3B | High School - Specializing | 11 - 12 | For students who wish to pursue the study of CS in high school beyond what is required for all students |

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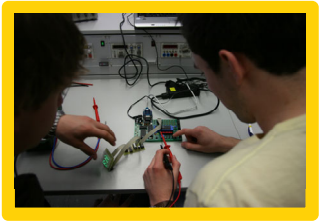

# Computer Science Implementation

## K-8 Integration Educator Perspective

**Mary Wever**
**Waverly Middle School**

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# Mary Wever




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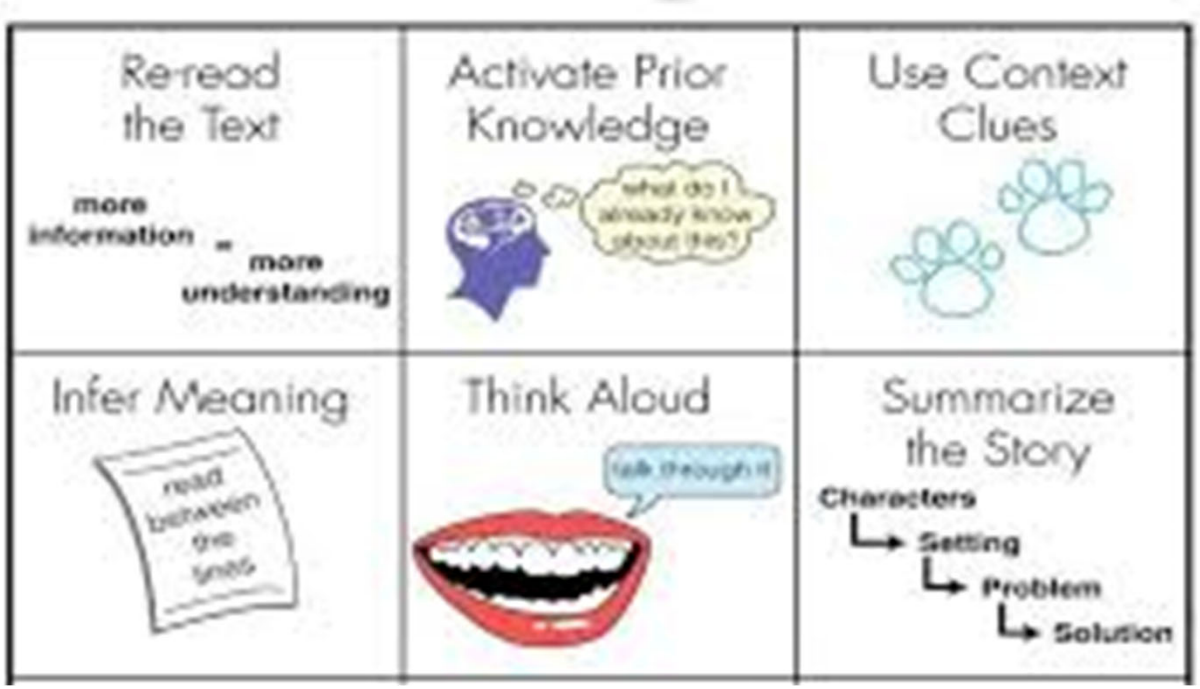
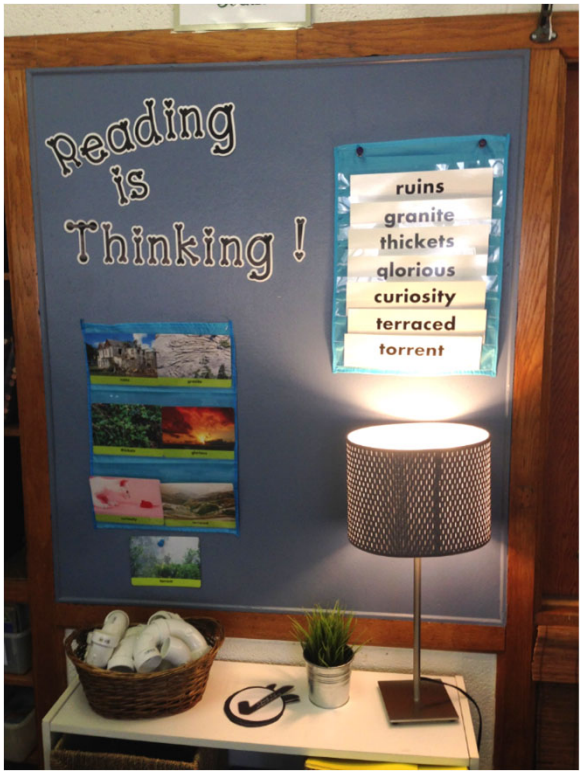
# Metacognition in Reading

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# Teachers are already teaching this!

They are just missing the common vocabulary to teach students how to think about their thinking with problem solving.


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## Data Collection

The process of gathering appropriate information.

- What sessions am I attending? Presenting at?
- What is my flight schedule?
- What social events are happening?
- What members of my PLN will be there?

## Data Analysis

Making sense of data, finding patterns, and drawing conclusions.

- Do I have any overlaps in my schedule?
- Are members of my PLN attending the same sessions/events?
- Can I share an Uber with someone in my PLN I've never met in person?

## Data Representation

Depicting and organizing data in appropriate graphs, charts, words, or images.

- Create and contribute to a shared PLN calendar
- Tweet and write blog posts about sessions
- Take notes during sessions (paper/pen, docs, SketchNotes, etc.)

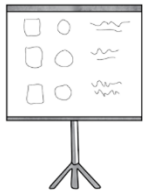
## Decomposition

Breaking down tasks into smaller, manageable parts.

Create packing lists based on:

- Dates/times
- Weather
- Events

## Abstraction



Reducing complexity to define main idea.

- Create my session schedule by only considering sessions focused on my grade level, a topic of interest, and session type
- Withdraw money at the ATM
- Sketch draft of my poster by representing ideas as squares, pictures as circles, and words as squiggles

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## Algorithms

Series of ordered steps taken to solve a problem or achieve some end.

- What is the easiest way to get from my hotel room to the conference center?
- How do I fold my clothes so they fit in my suitcase?
- How do I meet up with my PLN members when they are scattered around the city?

## Automation

Having computers or machines do repetitive or tedious tasks.

- Use QR codes to get session information
- Follow and use the conference hashtag
- Write an email "out of office reply" to be sent while you're at the conference

## Simulation

Representation or model of a process. Simulation also involves running experiments using models.

- Use the conference map to plot out how to get to your sessions so you can get there quickly
- Go to the presenter's lounge to test out your technology
- Video or audio record your presentation ahead of time

## Parallelization

Organize resources to simultaneously carry out tasks to reach a common goal.

- Attend a session and communicate the notes via social media
- Collaborate with others to present (Google Docs, phone calls, face-to-face meetings)
- Share presentation notes or exhibit hall raffles

Definitions retrieved from Computer Science Teachers Association (CSTA) and the International Society for Technology in Education (ISTE)
Image credit: http://leslefever.com/

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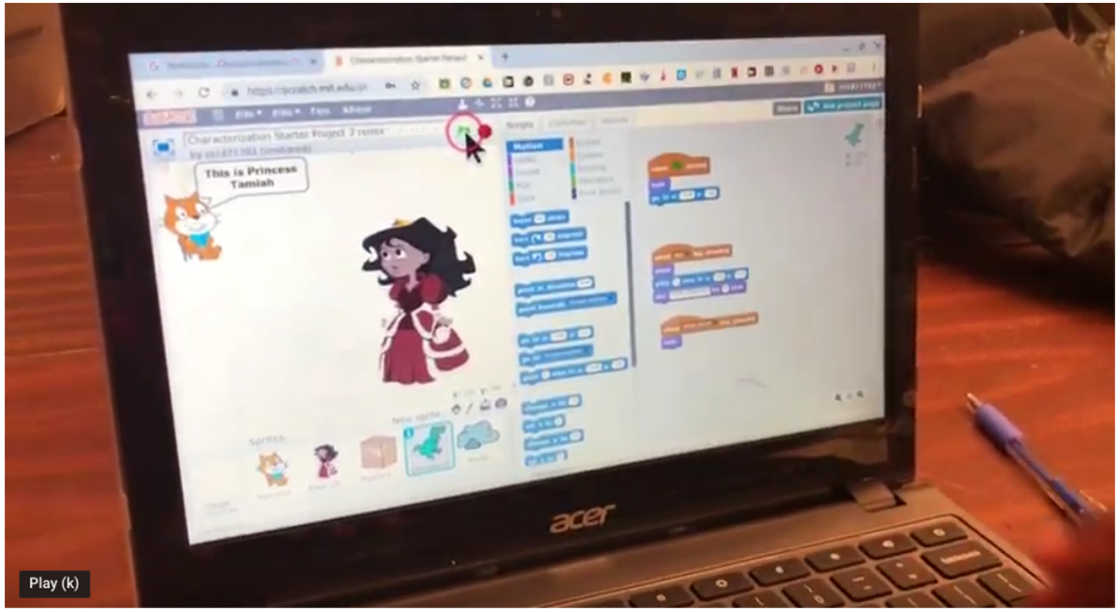


- **Tinkering**: experimenting and playing
- **Creating**: designing and making
- **Debugging**: finding and fixing errors
- **Persevering**: keeping going
- **Collaborating**: working together.

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# CS Resources for K-8 Educators

Code.org
Google CS First
Scratch (Scratch Jr.)
CS Unplugged
Ozobots
micro:bit
Hour of Code

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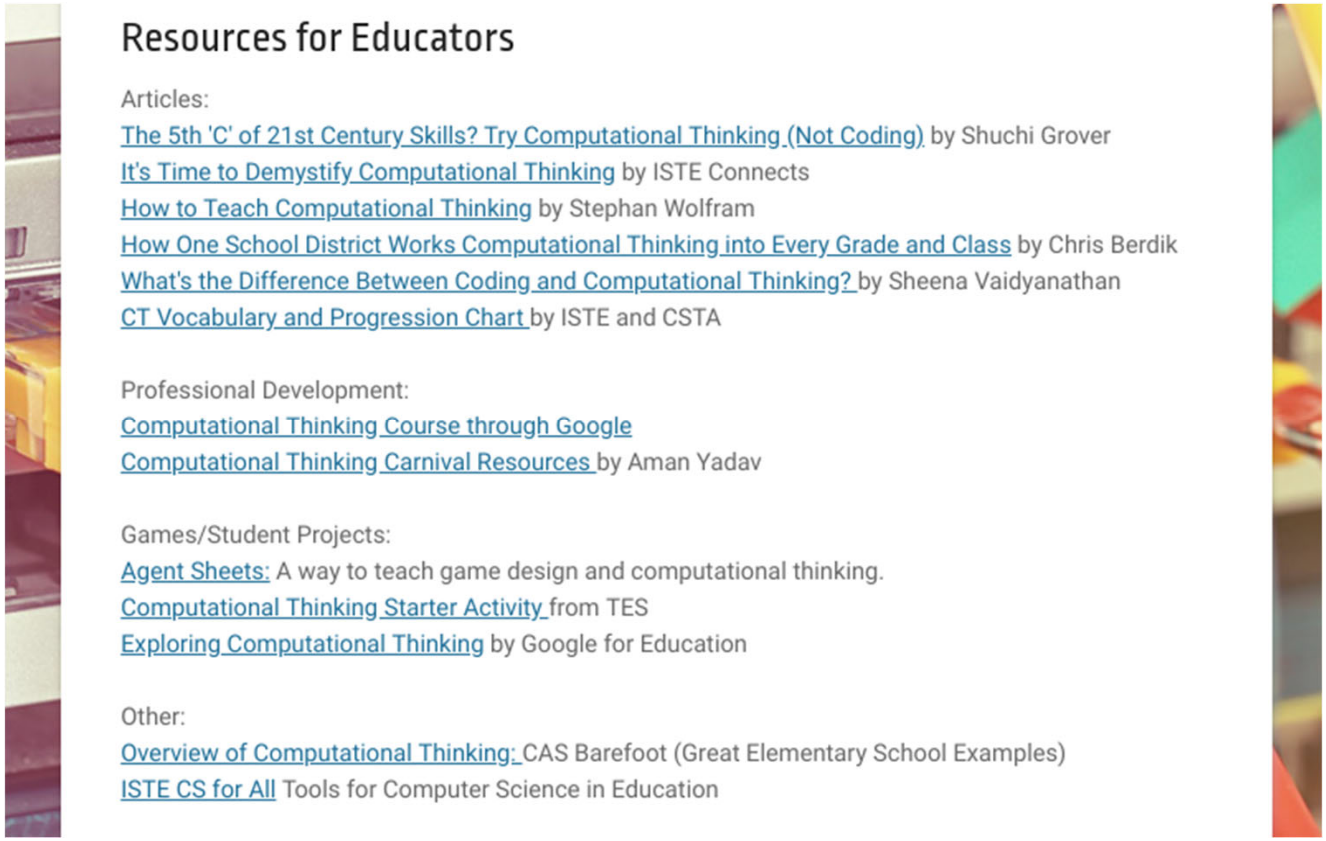
# https://www.smore.com/49d08



## Resources for Educators

Articles:

The 5th 'C' of 21st Century Skills? Try Computational Thinking (Not Coding) by Shuchi Grover
It's Time to Demystify Computational Thinking by ISTE Connects
How to Teach Computational Thinking by Stephan Wolfram
How One School District Works Computational Thinking into Every Grade and Class by Chris Berdik
What's the Difference Between Coding and Computational Thinking? by Sheena Vaidyanathan
CT Vocabulary and Progression Chart by ISTE and CSTA

Professional Development:

Computational Thinking Course through Google
Computational Thinking Carnival Resources by Aman Yadav

Games/Student Projects:

Agent Sheets: A way to teach game design and computational thinking.
Computational Thinking Starter Activity from TES
Exploring Computational Thinking by Google for Education

Other:

Overview of Computational Thinking: CAS Barefoot (Great Elementary School Examples)
ISTE CS for All Tools for Computer Science in Education

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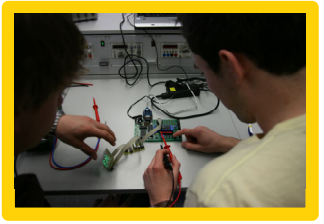

# Computer Science Implementation

**Secondary Educator Perspective**

**Cecilia M. Anderson**
**Math and Computer Science Teacher**
**East Lansing High School**

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# Three Examples of CS Implementation

(in a High School setting)

- Intro to Computer Science Principles – a general overview of Computer Science
- AP Computer Science A – a focused language (Java) course to meet AP testing needs
- Integrated into General Ed courses – applications of Computer Science in other disciplines

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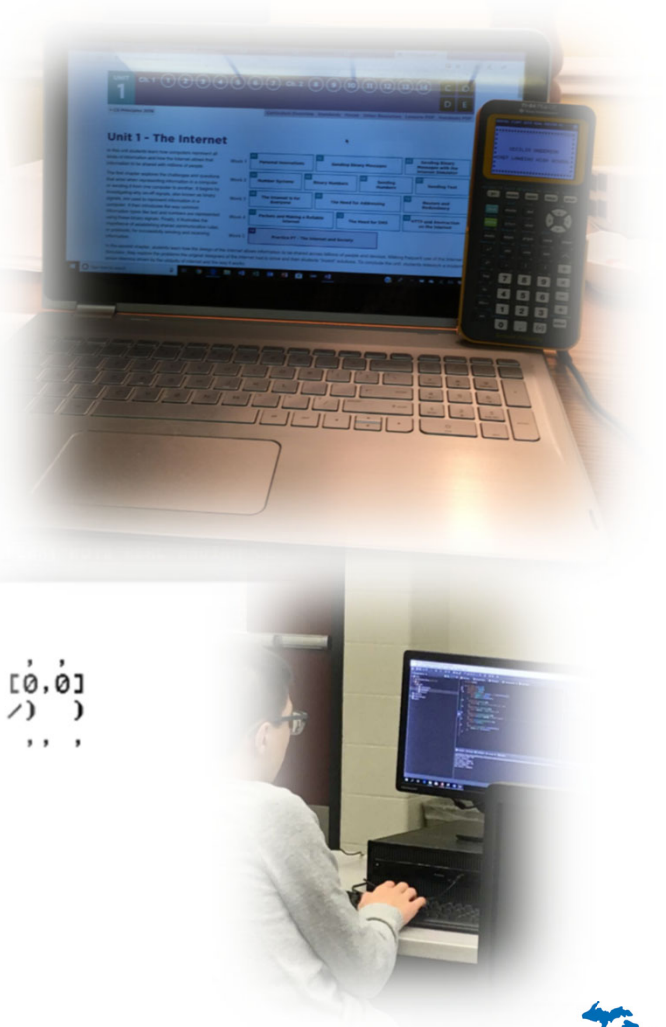
# ICSP

- It is a general population course for all students. It follows the TEALS program (code.org), blended with ti-codes.org and PBS's Crash Course Computer Science, fitted into a one semester time line.
- It covers most of the proposed K-12 standards.
- Sends students into other more specific courses based on their individual interests

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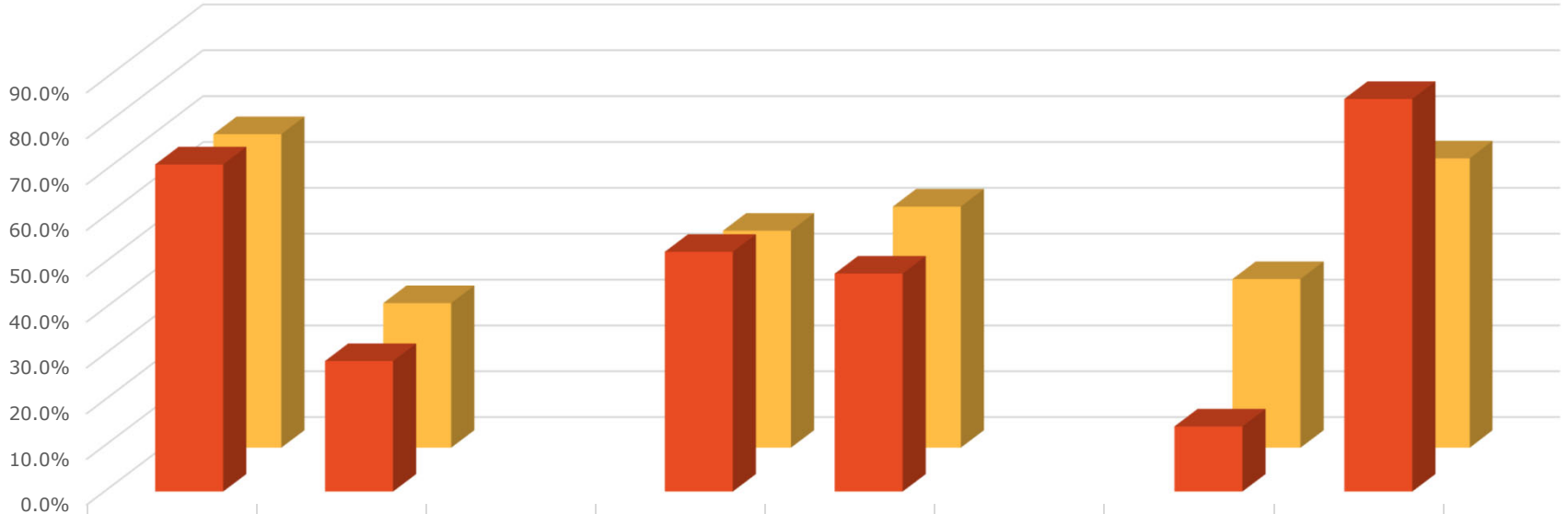
## ICSP 2018-19 population




| | Male | Female | | Non White | White | | Sp Ed | Gen Ed |
|---|---|---|---|---|---|---|---|---|
| sem 1 | 71.4% | 28.6% | | 52.4% | 47.6% | | 14.3% | 85.7% |
| sem 2 | 68.4% | 31.6% | | 47.4% | 52.6% | | 36.8% | 63.2% |

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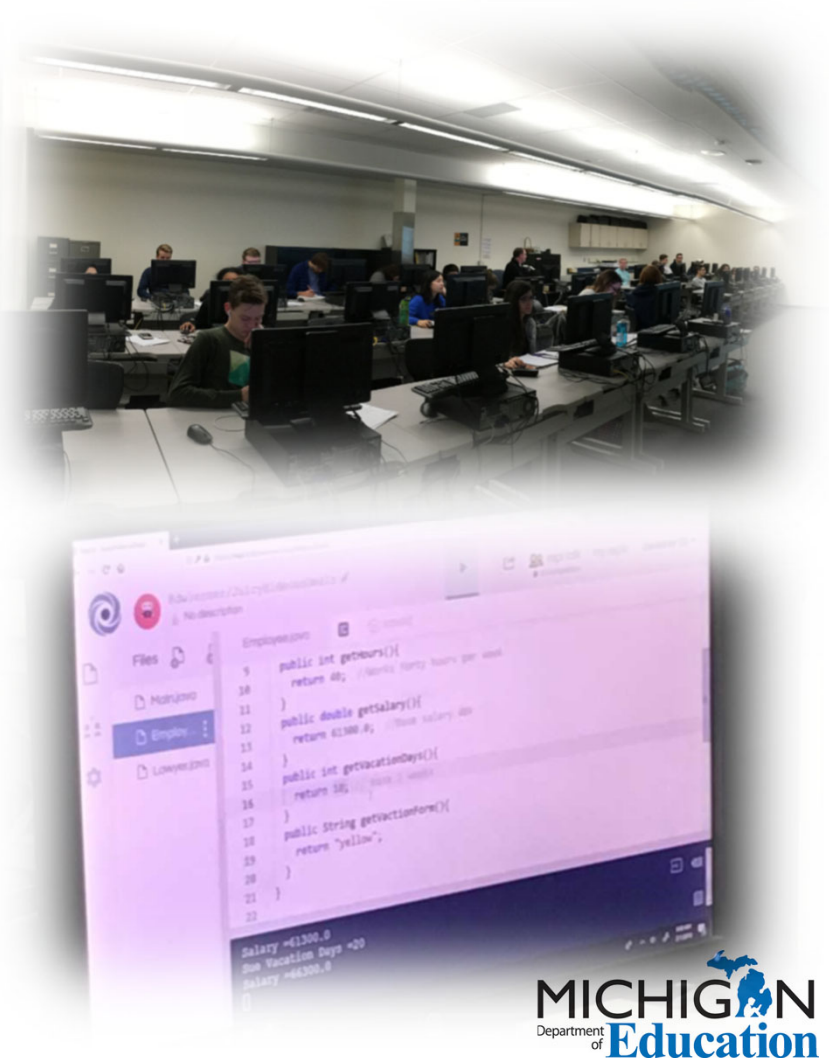
# APCS A

- This is a Object Orientated Programing course. It follows the TEALS program using the Co-Teaching model.
- It is language specific (Java) and is all coding.
- Has the expectation that students will take the AP Computer Science A test in the spring.
- A teacher will need the summer PD and will need access to experts from the field during the school year.



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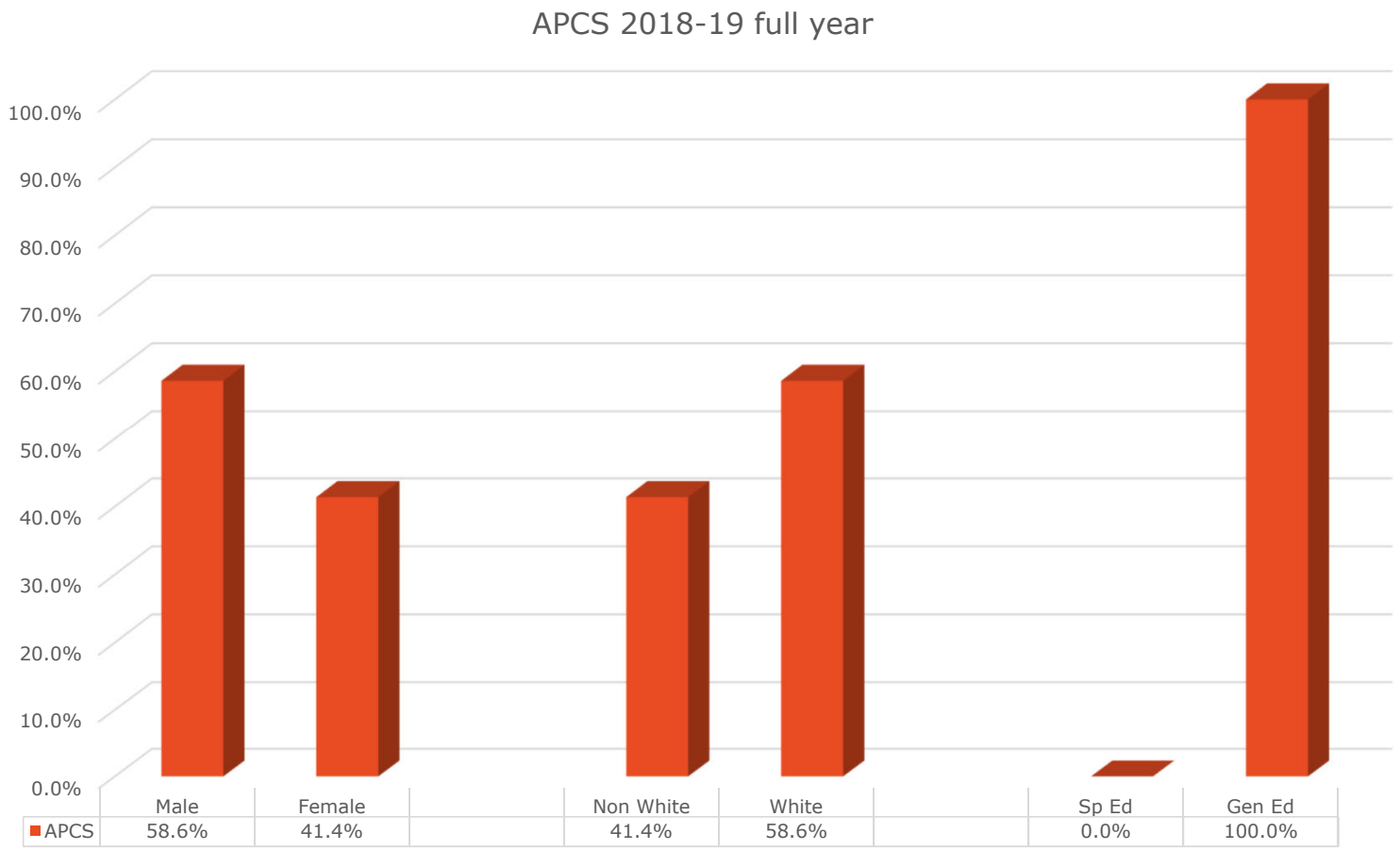
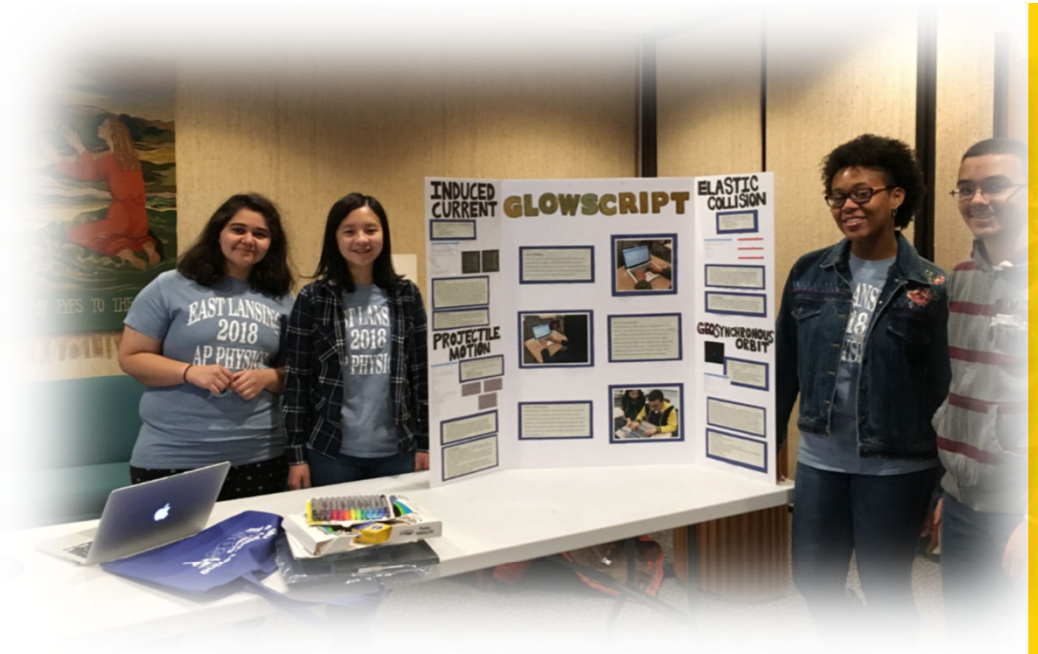

APCS 2018-19 full year
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Male
Female
Non White
White
Sp Ed
Gen Ed
APCS
58.6%
41.4%
41.4%
58.6%
0.0%
100.0%

# Integrated into Gen Ed courses

- GlowScript in Physics
- Computational Computing in Chem
- Hour of Code
- Stats (Big Data)
- Electives

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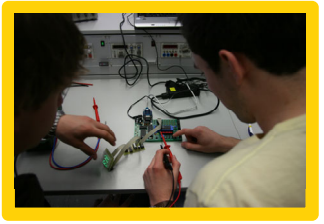

# Public Comment Opportunity

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# How to Provide Feedback

- Public Comment available January 14 – February 20, 2019
- www.Michigan.gov/mde-cs

The **Proposed K-12 Computer Science Standards** is available for review. The **Online Public Comment Survey** is open through February 20, 2019

Questions? Email wartellar@michigan.gov

MICHIGAN Department of Education

# Question and Answer Segment

- Open browser on your phone and type in sli.do
- Type in U294 and press return or enter
  - Type in your question (name is optional) and press send
  - Vote on questions you like to bring them up to the top of the queue
  - We also have notecards for those who would like to use them

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# Contact Information

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