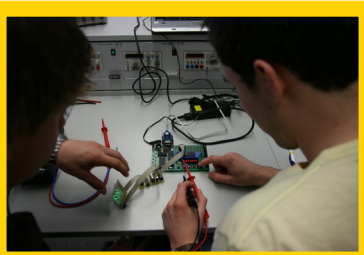

Michigan K-12 Computer Science Standards

Public Information Session

February 13, 2019

Wayne RESA

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Agenda

- Introduction – Sli.do audience participation
- What is computer science
- Urgency and Equity
  - Perspective from Jayme Danzig, Quicken Loans and Alexandra Orellana-Vlachakis, Detroit Public Schools Community District
- Standards Overview
- Computer Science Implementation
  - Taylor White and Alexandra Alexandra Orellana-Vlachakis Detroit Public Schools Community District
  - Josh Pudaloff, Troy Public Schools
- Question and Answer Segment – Sli.do

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Sli.do

- Connect to WiFi
- 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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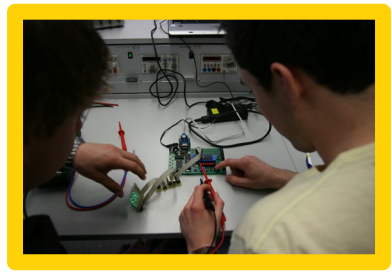

What is Computer Science?

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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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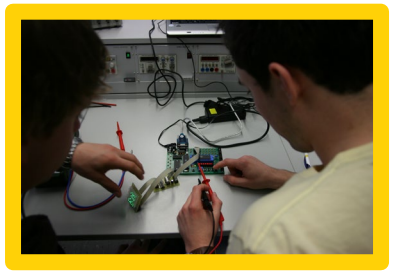

Urgency and Equity: Setting the Stage

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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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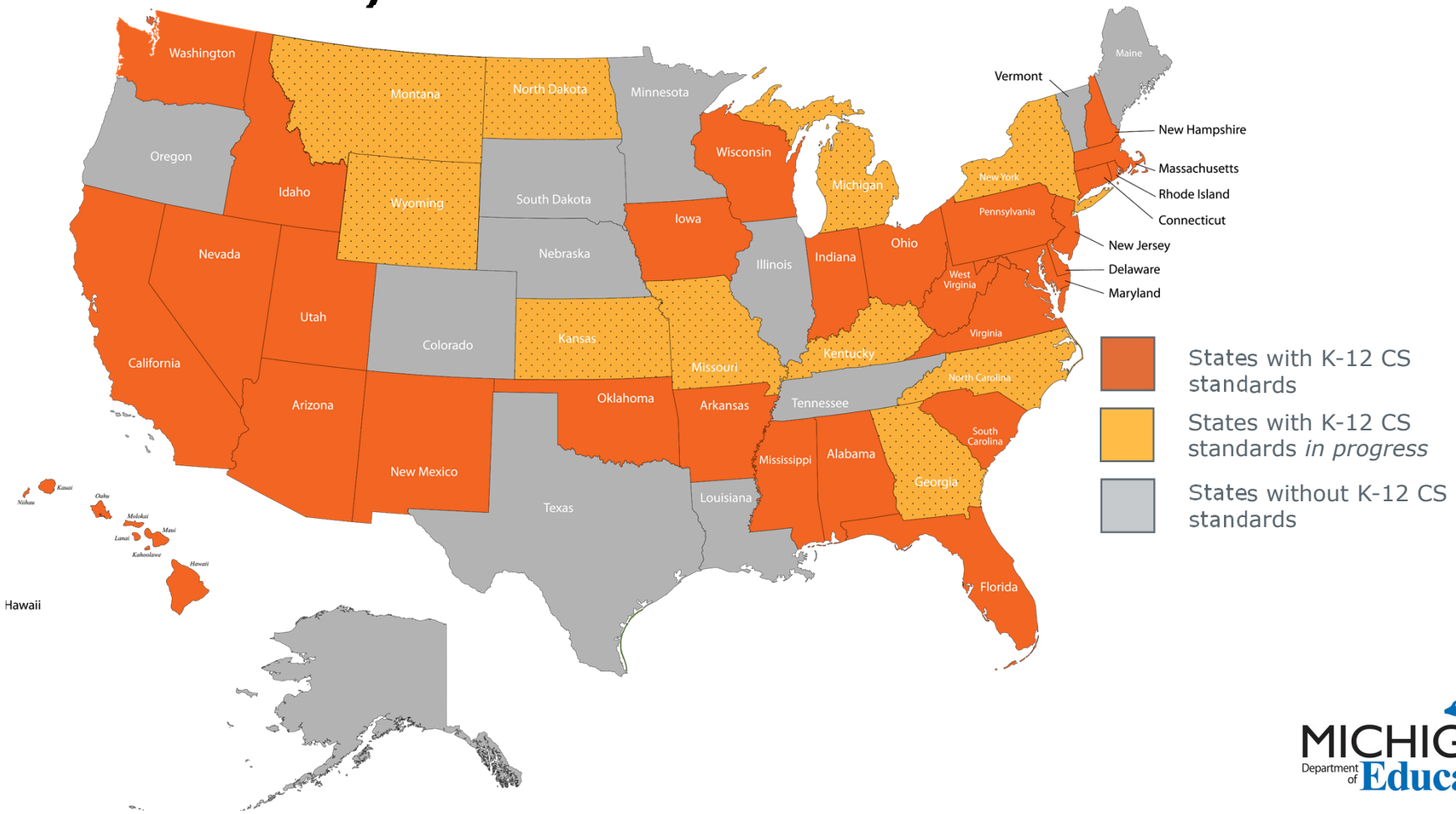
Computer Science Standards Adoption Nationally



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

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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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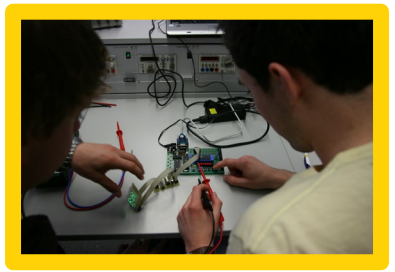

Urgency and Equity: Business and Industry Perspective

Jamye Danzig
Project Manager, Education & Employment
Quicken Loans

Alexandra Orellana-Vlachakis
Executive Director of Computer Science and Innovation
Detroit Public Schools Community District

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Quicken Loans & Detroit Schools Community District

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What we needed?

- DPSCD needed computer science in its classrooms
- Quicken Loans needed future employees with the right skills to communicate, compute, and quantify
- DPSCD needed to build an IT talent pipeline for the development of Detroit as a 21st-century community

Quicken and Detroit Schools

How did we get there?

- Quicken funded a full-time CS Executive Director @ DPSCD
- Quicken partnered with CSforALL, who worked with NYC on their CS Blueprint and implementation initiatives
- DPSCD participated in CS Script Workshop
- CSforALL, DPSCD and Quicken Loans worked together to develop a strategic plan to expose all students
- Working together, we have increased CS offerings in DPSCD
- Presented Quicken and School Commitments at the CS for ALL Summit in October, 2018

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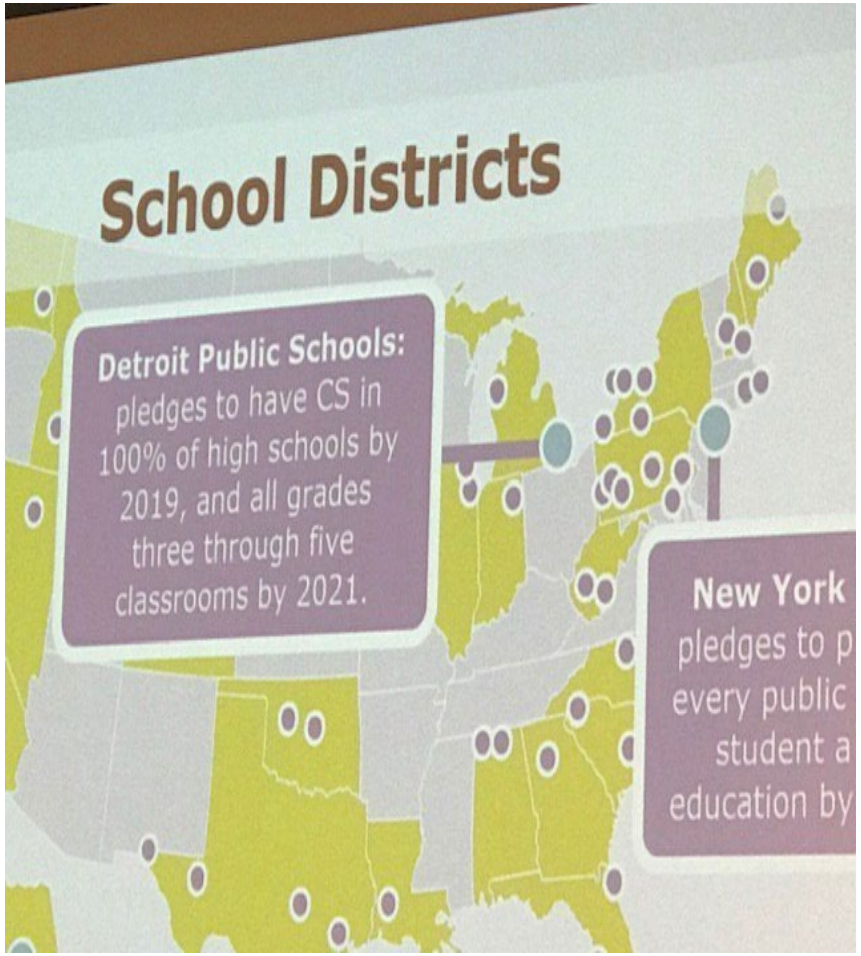
Quicken and Detroit Schools

Commit Statements



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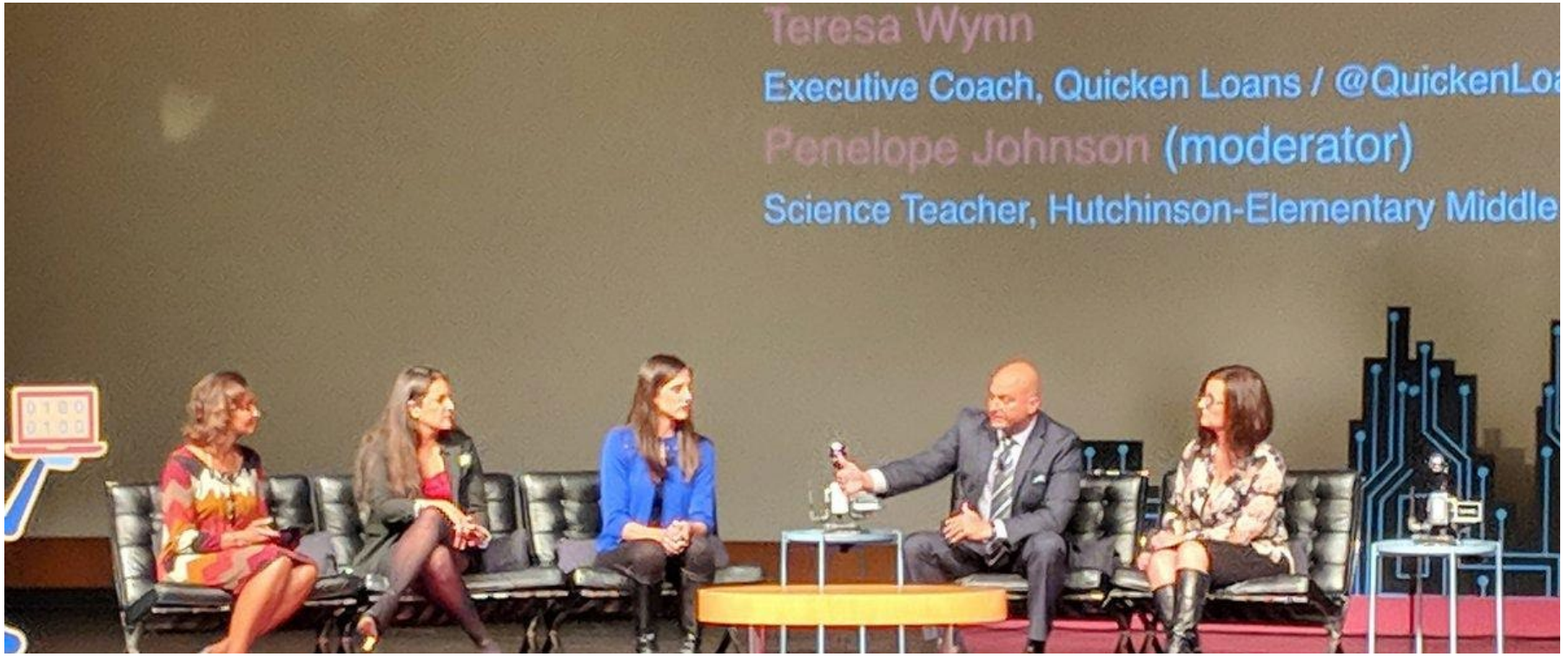
Quicken and Detroit Schools



CSforALL SUMMIT 2018
DETROIT | OCTOBER 8-11

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Quicken and Detroit Schools

Where we are now?

- Grade 3 CS in Science workshop: 1,125 WeDo robots distributed to classrooms
- Computer Science courses expanding to all DPSCD high schools next year

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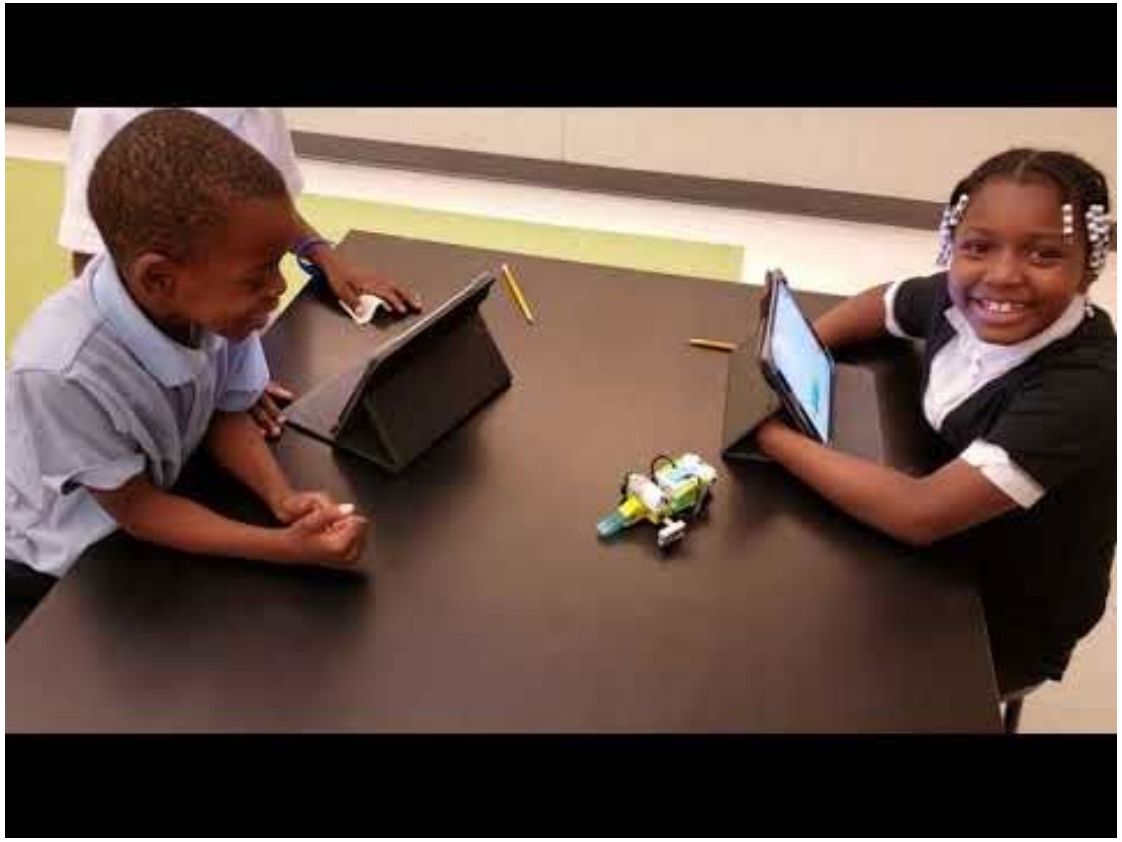
Quicken and Detroit Schools

Future of Computer Science for DPSCD



- Implement Middle School CS curriculum
- Build CS for Detroit Team
- Develop CSforDetroit Blueprint
- Create CS hub to include community partners to sustain the system

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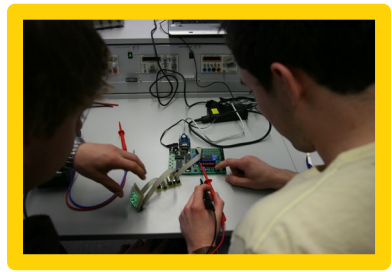

Standards Overview

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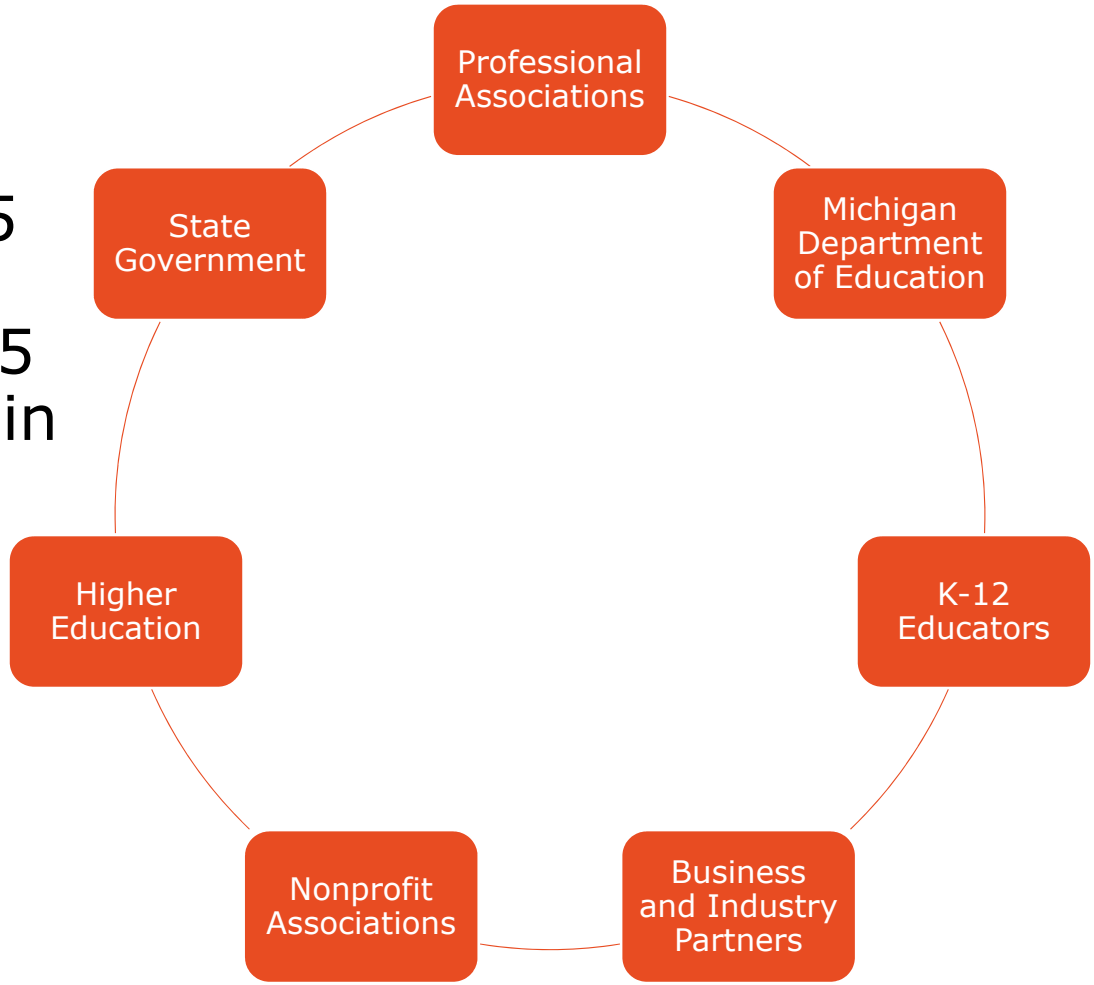
Process

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



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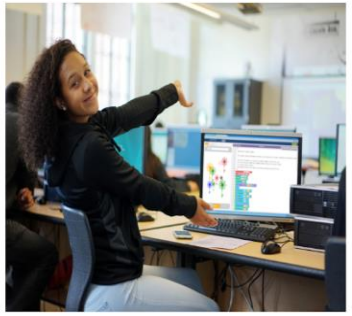
Agreed Upon Foundation

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

K12 COMPUTER SCIENCE FRAMEWORK



ast updated on October 19, 2016

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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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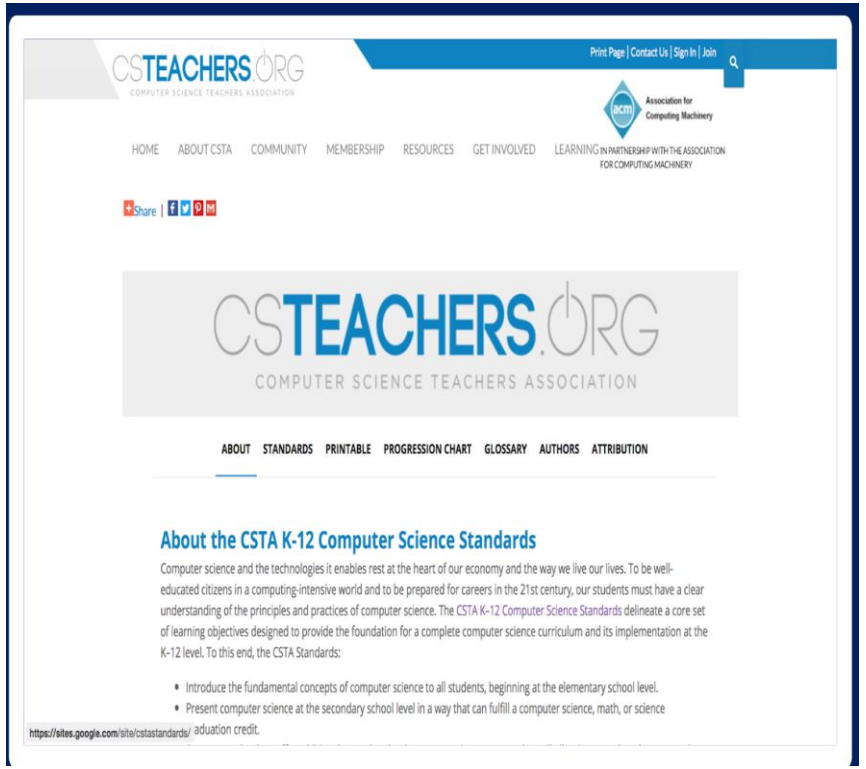
Agreed Upon Foundation

- Computer Science Teachers Association (CSTA) Computer Science 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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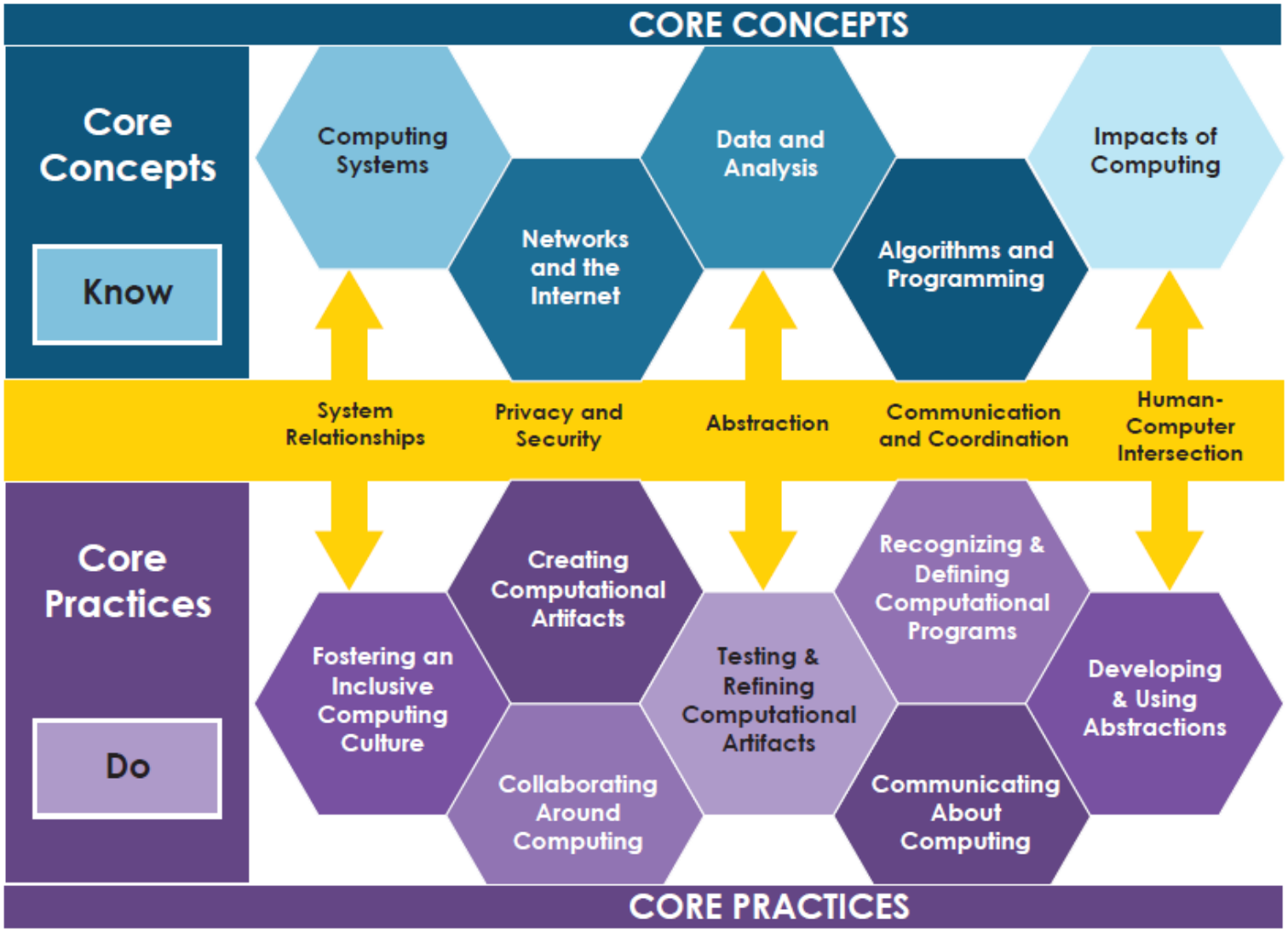

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Core Concepts

- 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

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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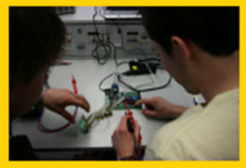

DRAFT

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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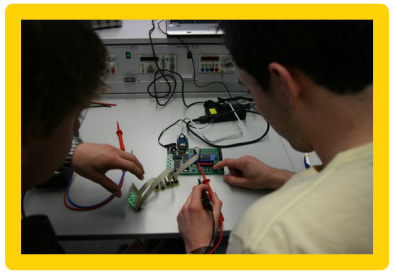

Computer Science Implementation

K-8 Integration Educator Perspective	K-8 Integration Educator Perspective
Taylor White, Kindergarten Teacher	Alexandra Orellana-Vlachakis Executive Director of Computer Science and Innovation Detroit Public Schools Community District

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Detroit Public Schools Community District

Literacy in Computer Science

Computer Science Terms

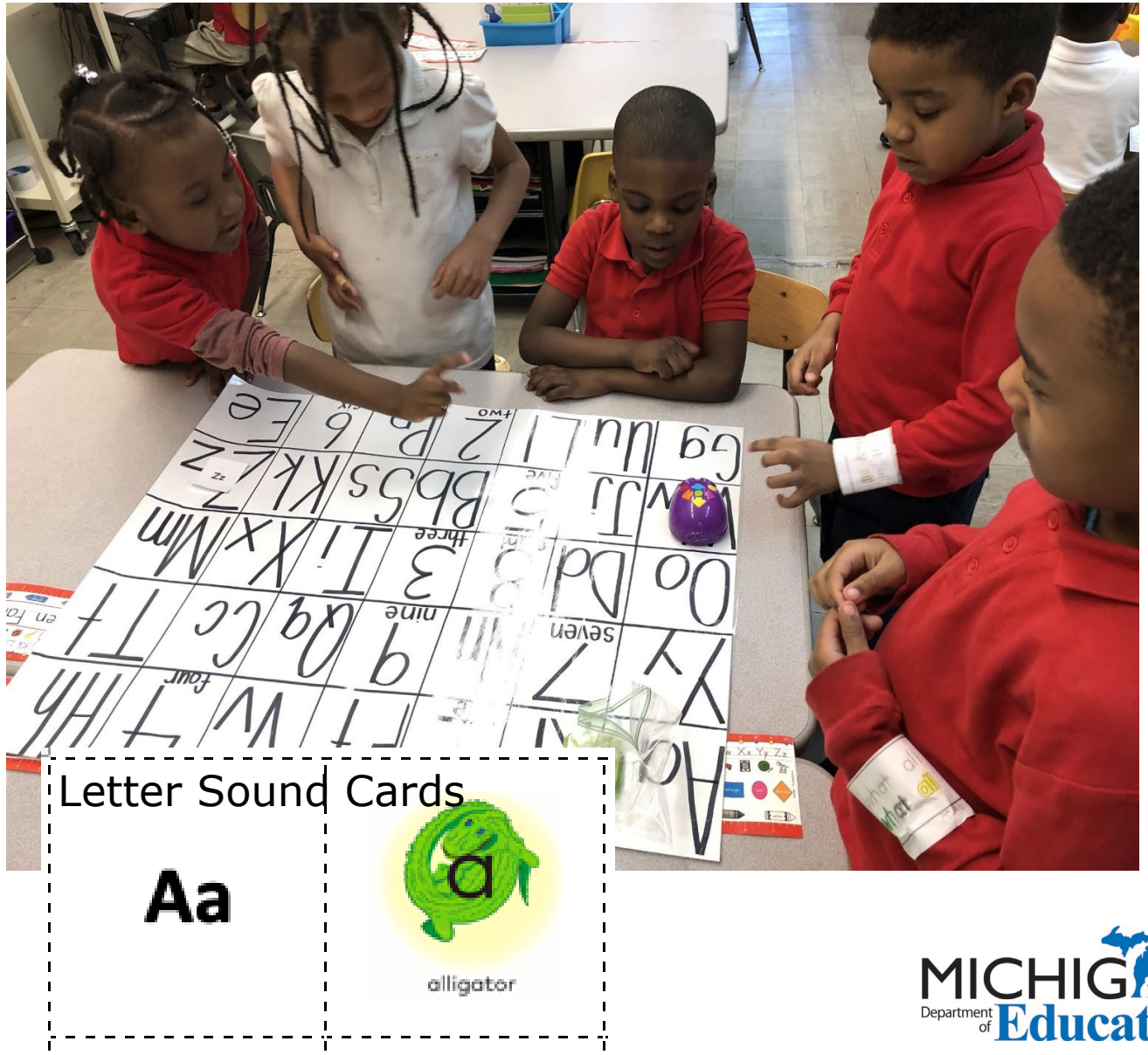
1. Debugging
2. Creating algorithms
3. Collaboration

Standards

ELA: RF.K.1.d- Recognize and name all upper- and lowercase letters of the alphabet.

Math:K.CC.A.2- Count forward beginning from a given number within the known sequence (instead of having to begin at 1)

Social Studies: K – G1.0.2 Use environmental directions or positional words (up/down, in/out, above/below) to identify significant locations in the classroom.



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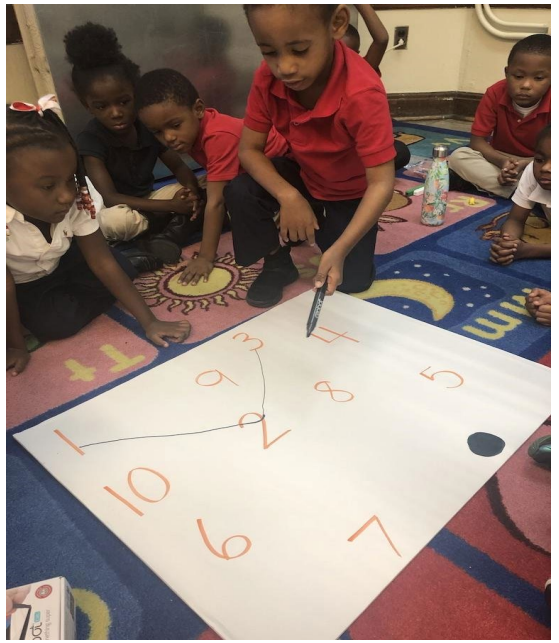
Mathematics in Computer Science

Lesson Objective

Students learn to count from one to ten by forging a number path



Standards

K.CC.A.1- Count to 100 by ones and by tens.

K.CC.A.2- Count forward beginning from a number within the known sequence.

- 1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.

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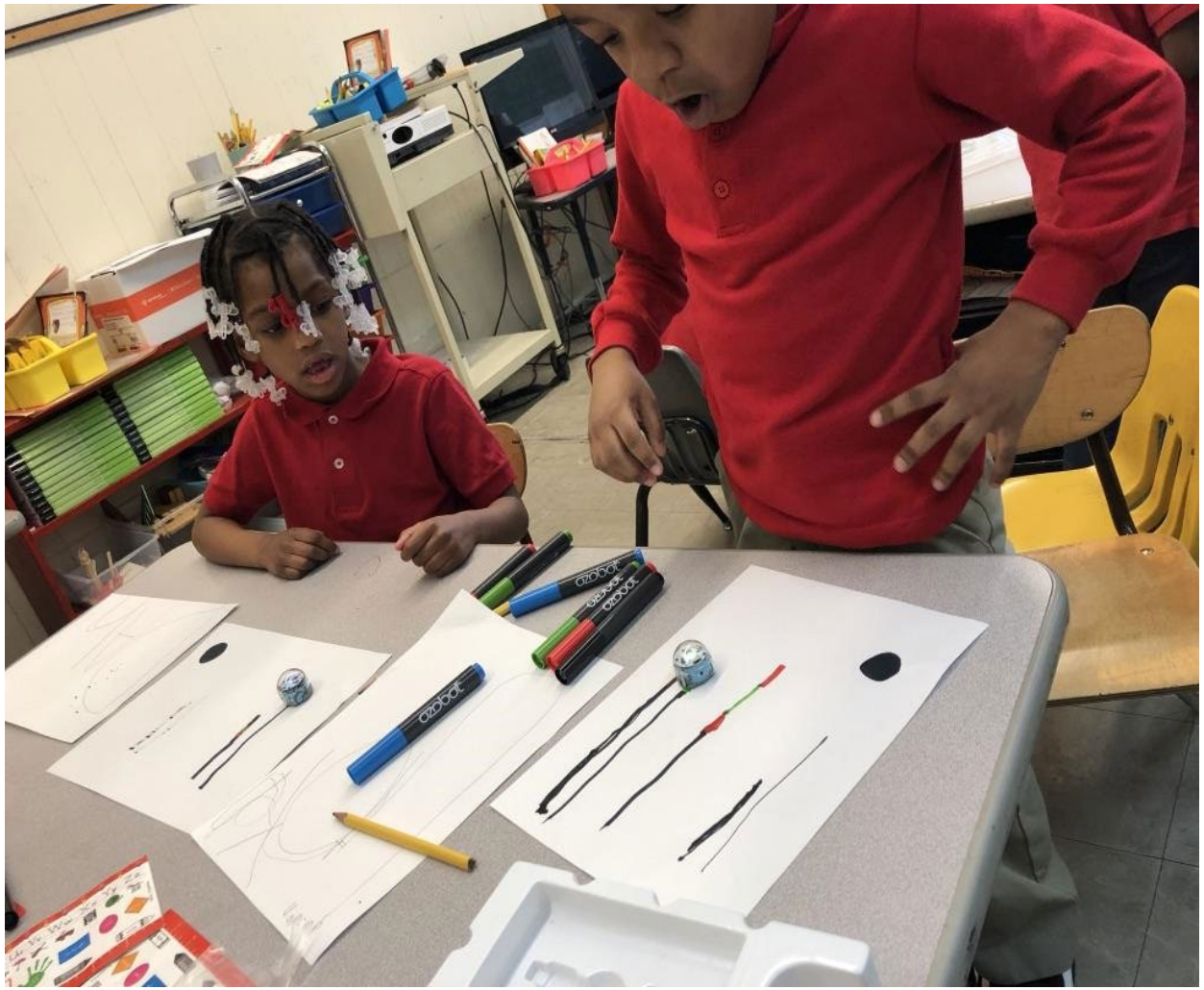
Teaching Foundational Skills

Lesson Objectives

1. Students identify colors, create patterns and draw straight lines
2. Students problem solve to make the ozobot jump from one line to the next.
3. Students work on fine motor skills.



Standards

1A-AP-14 Debug errors in an algorithm or program that includes sequences and simple loops.

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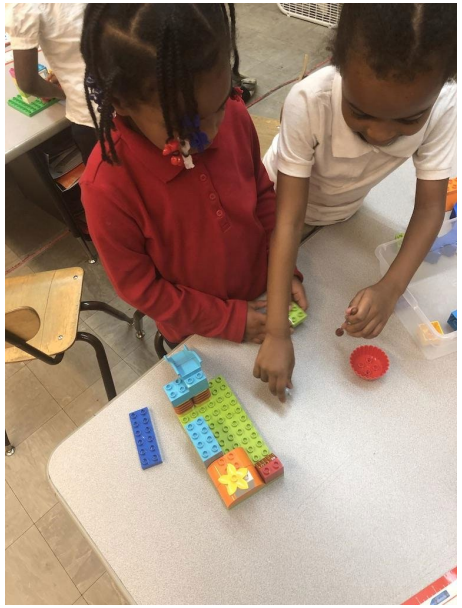
Computer Science and Collaboration



Computer Science provides opportunities for collaboration, equity and engagement in the classroom.

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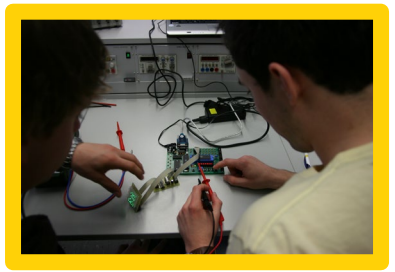

Computer Science Implementation

Secondary Educator Perspective

Josh Pudaloff
Computer Science and Math Teacher
Troy Athens High School

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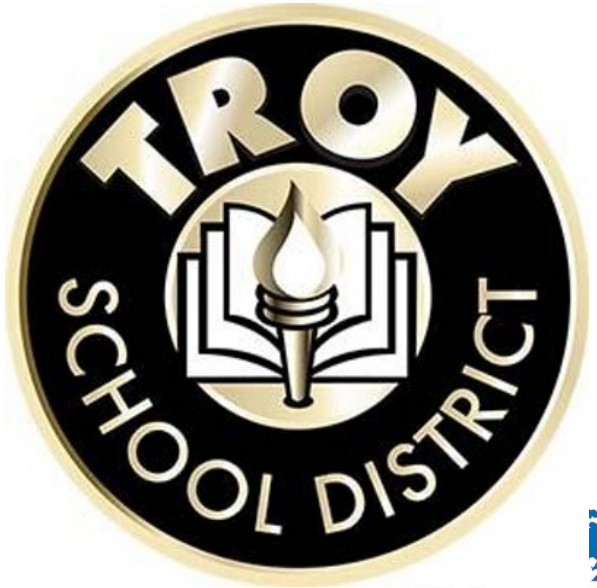
Josh Pudaloff

- Computer Science and Math Teacher
- Troy Athens High School
- B.S. Computer Science
- M.A. Teaching Math and Computer Science
- Michigan Dept. Ed. K-12 Computer Science Standards Development Committee



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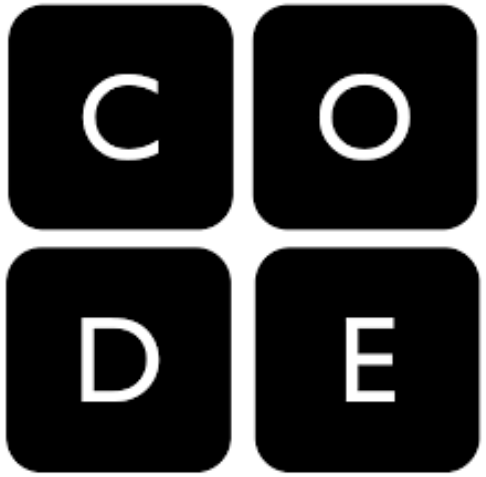
Personal Information

- President ~ Michigan Chapter Computer Science Teachers Association (MICSTA)
- College Board AP Reader – AP CS A
- Code.org PD Facilitator for Computer Science Principles



CollegeBoard

CSTA Michigan

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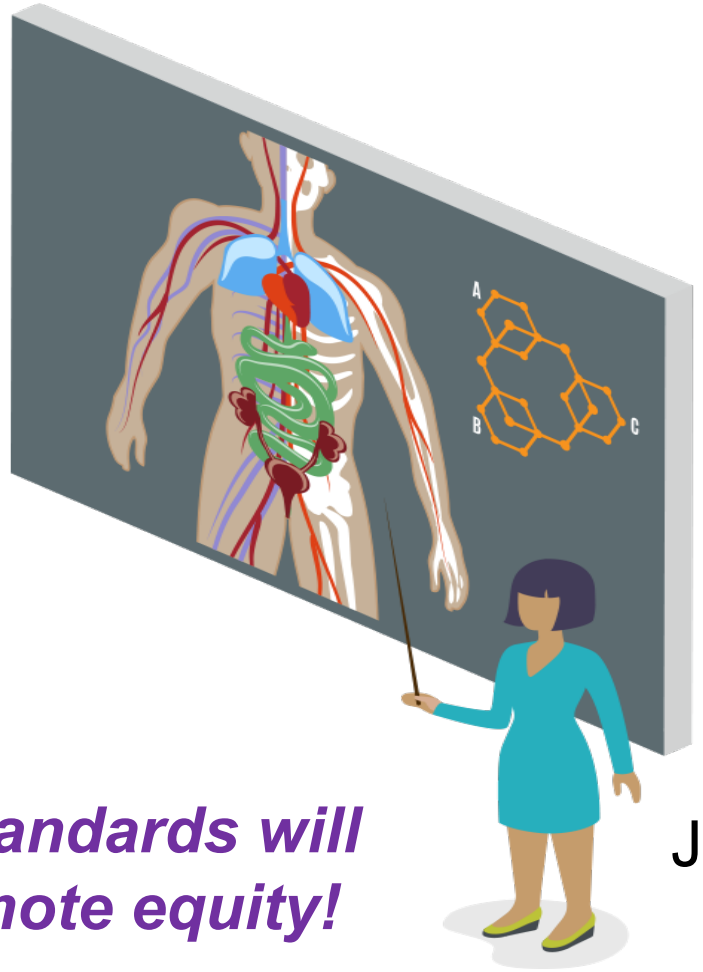
Every 21st century student should have a chance to learn about ***algorithms***, how to make ***apps***, or how the ***internet*** works.



CS Standards will promote equity!

Just like they learn about the ***digestive system***, ***photosynthesis***, or ***electricity***.

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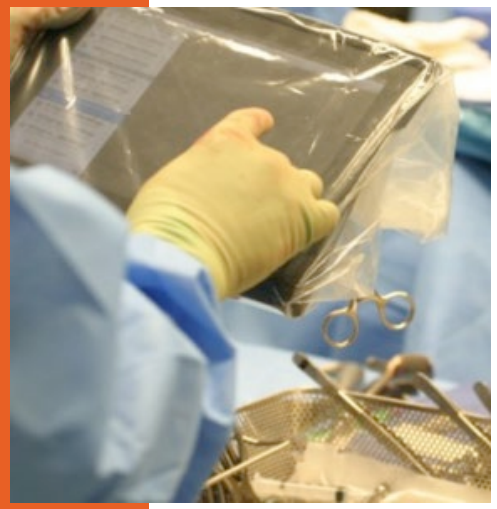
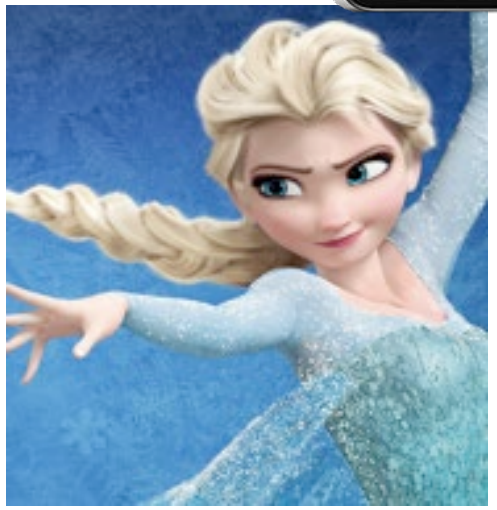
Technology affects ***every*** field:





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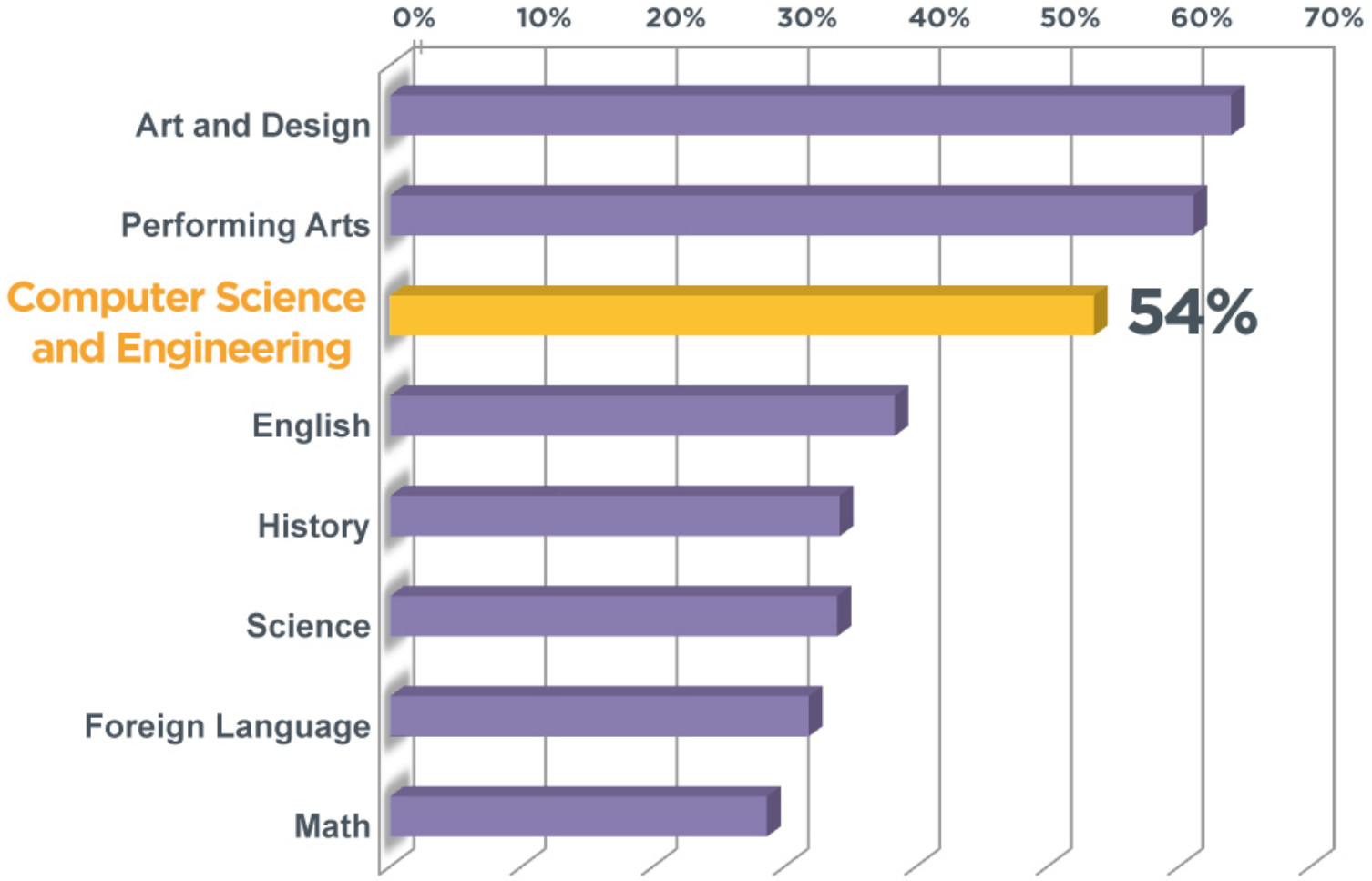
Students enjoy computer science and the arts the most



Source: Change the Equation

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Implementation Options

- Integration Into Existing Courses
  - CS is Interdisciplinary – Connections to Math, Science, English, Arts
- AP Computer Science Course
- Other Computer Science Class
- Partnership With TEALS/Industry

TEALS
computer science in every high school

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Two AP® Computer Science Courses

	Computer Science A	Computer Science Principles
Course Goal	Encourage skill development among students considering future studies & career in computer science or other STEM fields	Encourage broader participation in CS & STEM, including AP CSA
Curricular Focus	Problem solving and object-oriented programming	Big ideas of computer science (including programming)
Programming Language	Java	Teachers choose
Assessment Experience	▸ Multiple-choice and free-response questions	▸ Multiple-choice exam ▸ Two performance tasks administered by the teacher, and students submit digital artifacts

Resources and Support

- Michigan Coding Summer PD http://www.mi-coding.com/
  - Computer Science Principles
  - Computer Science Discoveries
  - Computer Science Fundamentals

Code.org® Regional Partner

- TEALS Partnership https://www.tealsk12.org/
- CSforAll https://www.csforall.org/
- AP Summer Institute
- Many more!!

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What college majors can you pursue with computing?

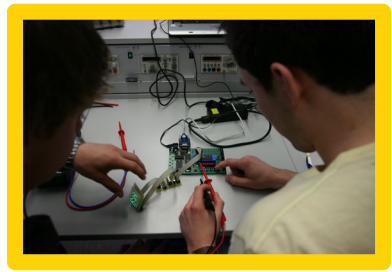
Colleges and universities offer many majors that make use of computing, like:

- Aerospace Engineering
- Applied Physics
- Astronomy
- Botany
- Business Administration
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Computer Forensics
- Computer Graphics
- Computer Science
- Economics
- Education
- Electrical Engineering
- Electronics Technology
- Environmental Studies
- Geography
- Geology
- Industrial Engineering
- Information Science
- Information Technology
- Linguistics
- Management Information Systems
- Marine Biology
- Mathematics
- Mechanical Engineering
- Molecular Biology
- Neuroscience
- Nuclear Engineering
- Physics
- Robotics Technology
- Statistics
- Studio Arts
- Web Development
- Zoology

What can your future be like?

- Advertising Manager
- Aerospace Engineer
- Aircraft Pilot
- Architect
- Art Director
- Astronomer
- Biomedical Engineer
- Chemical Engineer
- Coach
- Computer Programmer
- Editor
- Economist
- Electrical Engineer
- Dentist
- Forensic Scientist
- Financial Manager
- General Practitioner
- Geoscientist
- Graphic Designer
- Market Researcher
- Mathematician
- Medical Scientist
- Meteorologist
- Multimedia Artist and Animator
- Nuclear Engineer
- News Analyst, Reporter
- Pharmacist
- Physical Therapist
- Psychiatrist
- Real Estate Broker
- Statistician
- Surgeon
- Technical Writer
- Translator
- Veterinarian
- Web Designer



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

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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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