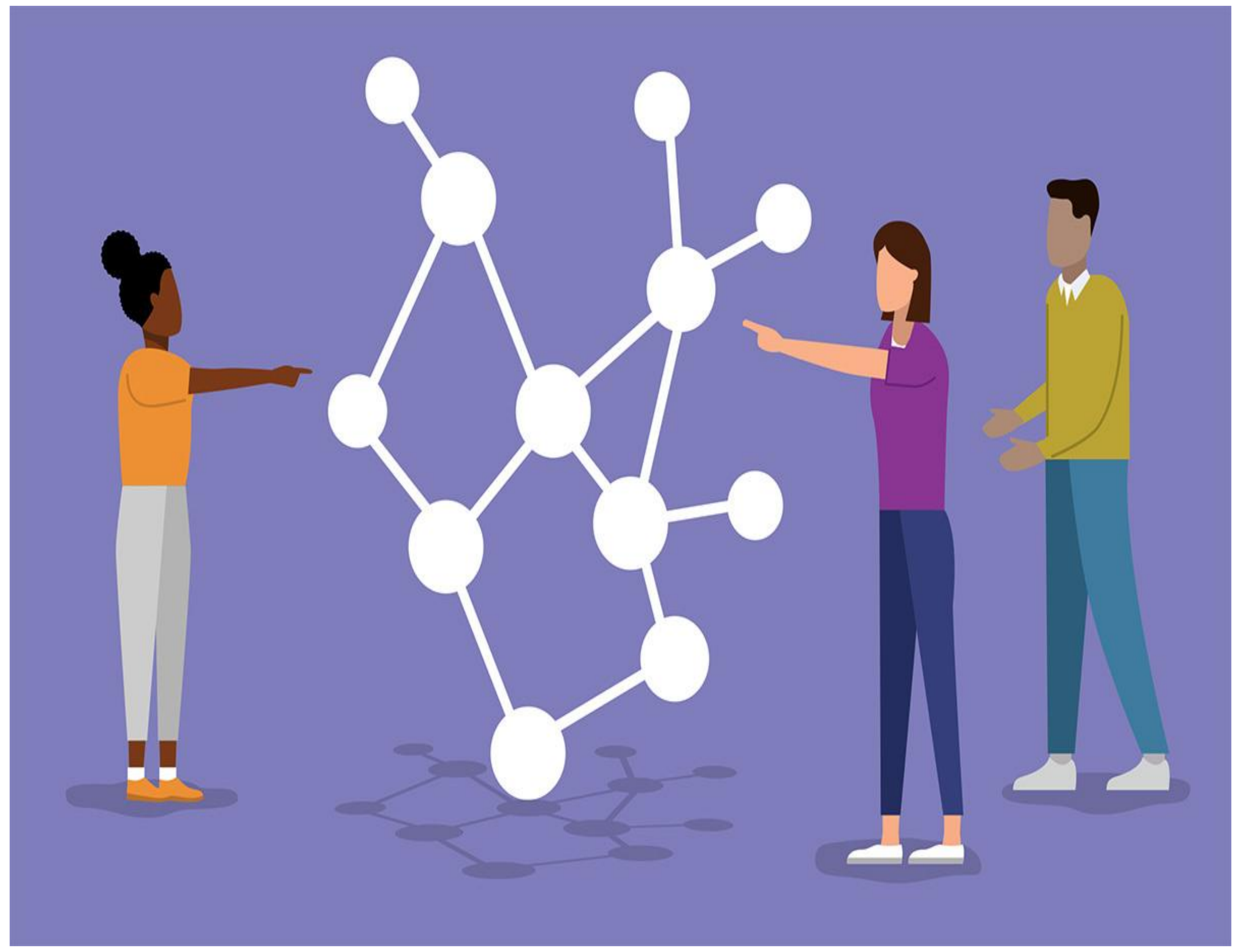
Understanding and Supporting District Systems Change Around Computer Science Education



Quinn Burke, Jeremy Roschelle, Pati Ruiz, & Josh Weisgrau

AERA Annual Conference Sun, April 11, 4:10 to 5:40pm EDT

Division L, Division L - Section 9: Policy Implementation and Going to Scale Structured Poster Session

Learning Sciences Research
Presented by Digital Promise

Digital Promise
Accelerating Innovation in Education

PreK-8 Integration

Commitment From District Leadership

Inclusive Participation of Students Historically Marginalized From Computing

Participatory and Iterative Design

Inclusive Participation of Students Historically Marginalized From Computing

Commitment From District Leadership

Digital Promise
Accelerating Innovation in Education

Digital Promise & the League of Innovative Schools

Computing Pathways Research Practice Partnership

District	Student Enrollment	Urbanity	% Low Income	% Latinx	% Black	Equity Focus Group
Iowa City Community School District (IA)	14,000	Becoming Urban	37	12	19	Greater inclusion of growing number of Black, Latinx and ELL students
Indian Prairie School District (IL)	28,000	Suburban	17	12	9	Title I schools with large achievement gaps compared to higher income schools
Talladega County Schools (AL)	7,500	Rural	71	2	33	Engaging students from low socio-economic households and female students

Digital Promise®
Accelerating Innovation in Education

Computing Pathways Research Practice Partnership

From the District's application:

"Our focus is on two specific populations, students from **low socio-economic households** and **female students**. Of the high school students currently enrolled in a computer science or engineering course,

- **16% of our more affluent students** are enrolled, while only **4% of our students in poverty** are enrolled.
- Only **30% of the students are female**

Talladega County Schools (AL)	7,500	Rural	71	2	33	Engaging students from low socio-economic households and female students

Our District Leaders

Talladega County Schools (AL)

Brooke Morgan
Coordinator, Innovative Learning
Talladega County Schools

Iowa City Community School District (IA)

Adam Kurth
Director of Technology and Innovation
Iowa City Community School District

INDIAN PRAIRIE SCHOOL DISTRICT

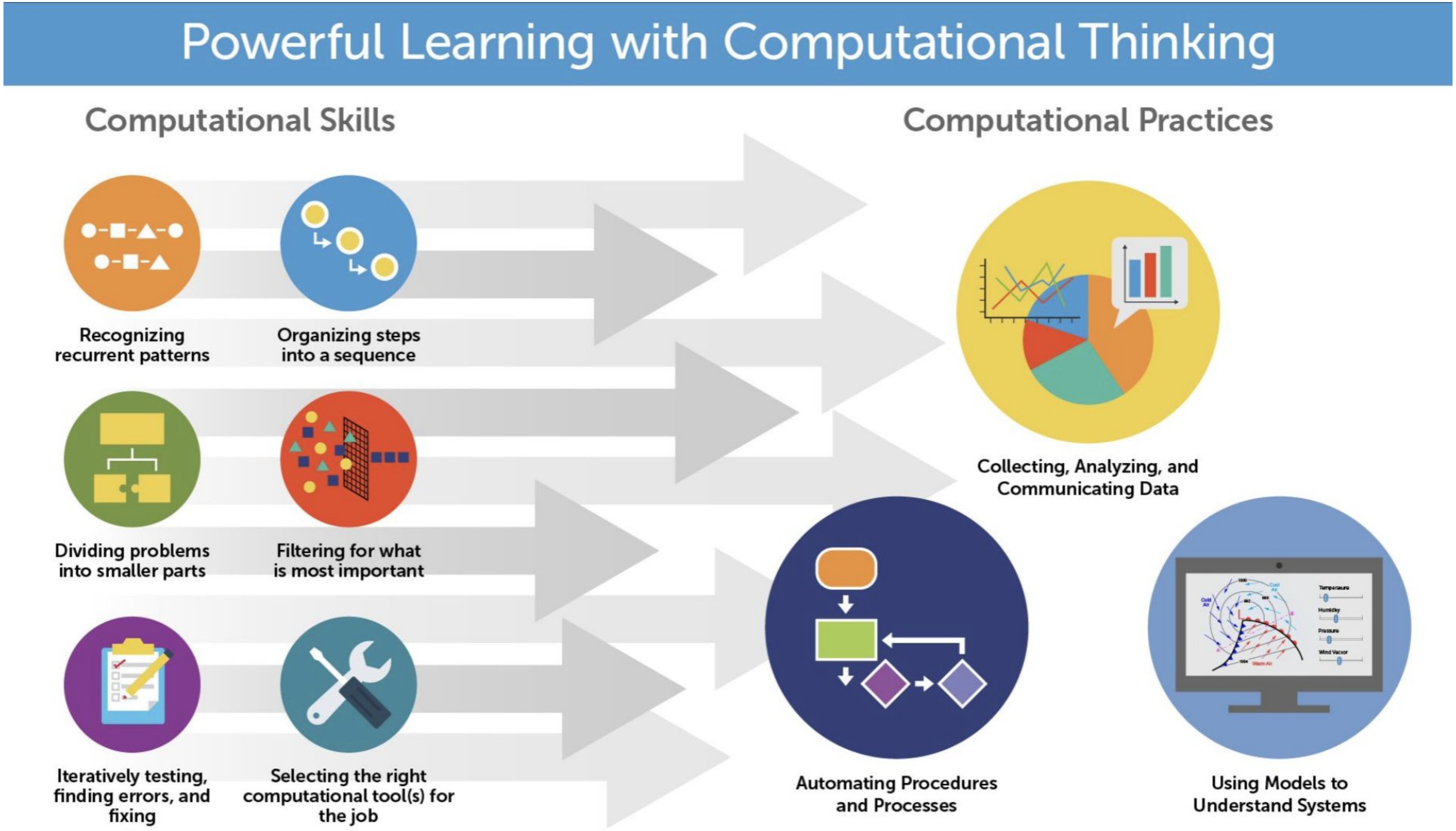
Brian Giovanini,
Director of Innovation
Indian Prairie School District

Digital Promise
Accelerating Innovation in Education

PreK-8 Integration

Participatory and Iterative Design

A Focus of Competencies: *What are the key skills & practices?*



Digital Promise
Accelerating Innovation in Education

Talladega's CT Pathways Map

TCBOE DLCS Standards **Computational Thinking Pathways**

Grade K:
*By the end of Grade K, what will ALL students **know and be able to do**?*

Relevant Standards (*From Alabama DLCS*)	**What do the Standards Mean?** (*Unpack/ Restate in your own words.*)	**Key Vocabulary** (*Students will KNOW / understand…*)	**What Does it Look Like in Class?** (*Students will be able to DO…*)	**Opportunities to Learn (Lessons, Resources, etc.)**
ALGORITHMIC THINKING				
DLCS 1. List the sequence of events required to solve problems. Examples: tying shoes, making a sandwich, brushing teeth.	I can identify the order of events related to a specific task. I can identify what comes next or if a step is out of order. I can tell the order of events for a specific task. I can identify what comes next for specific tasks. I can identify a step that is not in the correct order.	**Algorithm:** A precise sequence of instructions for processes that can be executed by a computer **Bug**: Part of a program that does not work correctly **Debugging**: Finding and fixing problems in an algorithm or program **Sequence -** To arrange in a particular order	**ELA** - Write informational or explanatory text, such as how-to articles - Create/draft outlines for writings or projects - Express a routine as a sequence of step-by-step instructions - Map or outline a story - Create decision trees **Math** - List the steps to solving math problems. -Determine when a task is not in the correct order. -Order a sequence of events. **Science/SS** - List steps for a process. - Create if/then statements for concepts. -Order a sequence of events related to an experiment.	https://www.kodable.com/ Students use basic coding skills to follow a sequence. Beebot Challenge Cards Lesson where students follow directions to get the Beebot from point A to point B. Nearpod Lesson: Room on the Broom Story sequencing. Seesaw: Sequence the Story Activity for story sequencing that can easily be assigned to students. Debugging: Unspotted Bugs A lesson to help students understand the step involved in debugging.

Overview - Focus on Teacher Capacity

In Year #3, development activities have supported pilot teachers (within each Core district) to implement the inclusive pathway.

- Designing, implementing, and iterating on professional development resources for teachers (largely, K-8)
- Centering equity in the development of resources and tools to support the pathway.
- Teachers enacting PD within their own classrooms
- Making improvements based on implementation experience & identifying common challenges & opportunities (via teacher interviews & focus groups)

Computational Thinking Pathways Toolkit

The **CT Pathways Toolkit** is a resource for school districts to guide them in the design and articulation of their own system-wide K-12 learning pathway in computational thinking (CT) and computer science (CS). The purpose of a pathway is to involve all students in a district in learning critical CT and CS skills throughout their K-12 education.

Step #1 Articulating the Why?

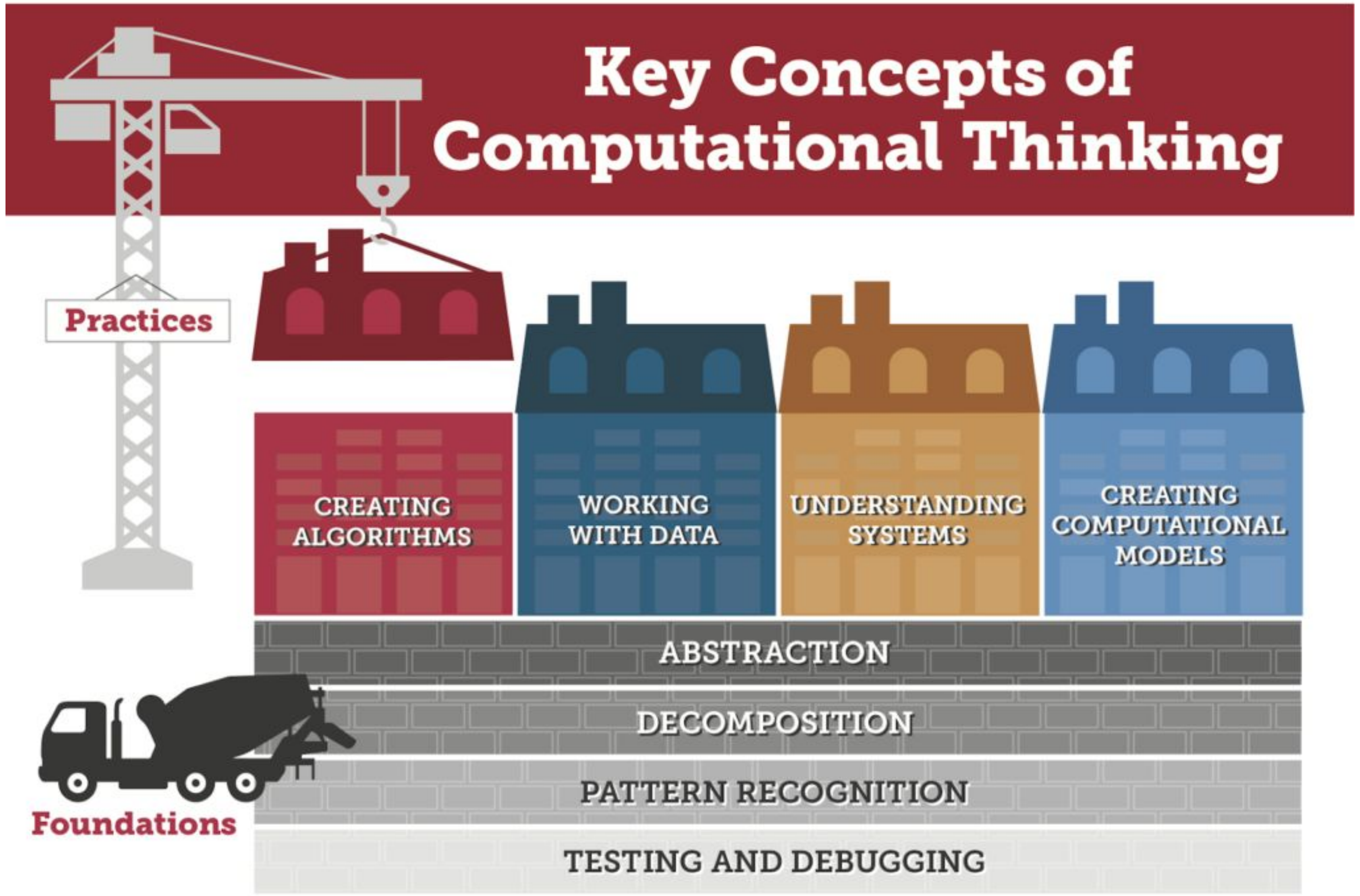
Why?

- Vision
- Foundations
- Strategic Alignment

Why is this a priority for your schools and district? Where does the vision align with current initiatives?

Digital Promise
Accelerating Innovation in Education

Step #2 Defining & Communicating the What?



What?

- Lead
- Identify
- Define

The core of your initiative will be specific CT competencies for each grade band, defined in language your team can understand and communicate effectively.

Digital Promise
Accelerating Innovation in Education

Step #2 Defining & Communicating the What?

"(T)here are some organizations that have up to 10 [essential components of CT]....We thought 10 was just too big of a number to try -- and it's not to say that we're not going to teach those other ones or introduce those. They're just not going to be the core five. These are the core five that we felt like we saw already embedded across the curriculum."

- Dr. Brooke Morgan, Coordinator of Innovative Learning, Talladega County Schools

Digital Promise
Accelerating Innovation in Education

Step #3 Establishing the How?

How?

- Who are your district leaders
- How do these competencies stretch across grade levels?
- How do you measure success?

Planning the professional learning that will drive progress as well measurements (i.e., using “look fors”, surveys) to benchmark progress in classrooms.

Digital Promise
Accelerating Innovation in Education

Districts Piloting

District Name	Context	Demographics	Equity Challenge (from District Leads)
Broward County Public Schools, FL	Large Urban 329 schools 269,098 students	Title I: 58% Black: 39% Latinx: 35%	*We need to develop a CS/CT pathway for K – 5 students that includes standardized, integrated curriculum for <u>all</u> students during the regular school day. Additionally, we need to expand enrollment in CS courses and opportunities for 6 – 12 students. The pathway needs to be aligned with industry certification to provide incentives for all students.*
Fullerton County Schools, CA	Urban 20 schools 13,700 students	Title I: 49% Black: 1% Latinx: 51%	*A challenge we face for teachers Is understanding the why and finding purpose. I know the toolkit will help in that area.*
Kettle Moraine Public Schools, WI	Suburban 6 schools 3,900 students	Title I: 10% Black: 1% Latinx: 5%	*While the district already has a solid offering of middle and high school offerings, Kettle Moriane intends to (a) develop a comprehensive K-12 pathway and (b) broaden access for its elementary students with coursework that offers a "lead into" middle school curricula*
Mineola Public Schools, NY	Suburban 5 schools 2,878 students	Title I: 31% Black: 3% Latinx: 31%	*Mineola will continue the work of our Districtwide Computer Science/ Makerspace Committee, started four years ago. We have teacher and administrator representation from all five buildings (PreK-12). We will identify elements of our integrated curricula that <u>explicitly</u> embed elements of CT. More specifically, we also we would like to be able to run computer science classes in Spanish for our entering ELLs.*

Districts Piloting II

District Name	Context	Demographics	Equity Challenge
North Salem Central School District, NY	Suburban 2 schools 1068 students	Title I: 12% Black: 2% Latinx: 15%	*The first issue of equity is that not all of our students have equal and consistent learning experiences in relation to computer science and computational thinking. Experiences with CT and CS are isolated and in pockets. We'd like these pockets to be connected and for students to see the connections to computational thinking across subject areas and experience even learning in these areas K-12/. Although our numbers of male and female students in our AP CS course have improved, the course has been typically taken by white, male students. We eliminated CSA and last year began providing CSP. We'd like to be able to offer both and have the courses reflect our student population (female, male, and students of color).*
Vandalia Community School District, IL	Rural 3 schools 1,440 students	Title I: 57% Black: 3% Latinx: 2%	*CS and CT thinking doesn't come to the forefront of the teachers mind while teaching a particular content area. There are huge opportunities for growth in bringing CT awareness to teachers. Most are implementing CT to some extent, but they don't realize they are doing it. Integration will be key to creating the buy-in to this new wave of thinking.*
Kodiak Island Borough School District, AK	Rural 6 town schools 7 rural schools 2250 students	Title I: 47% Black: 1% Latinx: 8%	Teacher's lack of knowledge about CS/CT programs and applications definitely factor into equity challenges in the district. Furthermore, students from diverse racial backgrounds (primarily Filipino and Alaskan Native) do not have an opportunity to explore CS applications. Another big challenge is getting teachers on board with adopting and integrating CS/CT activities within their schedule, one already filled to the brim with focuses on ELA and math development.

Districts Pilot Progress

Digital Promise
Accelerating Innovation in Education

District Name	Start	Why?		What?		How?	
		Set the Vision	Strategic Alignment	Identify Key Competencies	Develop Competency Map	Professional Learning	Measurement & Assessments
Broward County, FL	Jan 2021	✓	✓	✓	🚗		
Fullerton County Schools, CA	Summer 2021						
Kettle Moraine Public Schools, WI	May 2021	🚗					
Mineola Public Schools, NY	Summer 2021						
North Salem, NY	Feb 2021	✓	✓	✓	🚗		
Vandalia, IL	Mar 2021	🚗					
Kodiak, AK	Fall 2021						

Thank you for joining today!

This work was supported by the National Science Foundation under grant award #1837386.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF.

Link to CT Pathways Toolkit

https://bit.ly/36szXLy