SD K-8 Getting Grounded: Understanding and Exploring South Dakota's Computer Science Education Landscape

bit.ly/BHSUCSSD

Presenters

Nicole Uhre-Balk

BHSU Learning Specialist
-Middle & High School
Biology and CS Teacher

Hannah Caffee

BHSU Learning Specialist
-Middle & High School
Science Teacher

bit.ly/BHSU
CSSD

SOUTH DAKOTA
NSF EPSCoR
ADVANCING GEOGRAPHIC DIVERSITY IN STEM

Session Objectives & Goals

- Build educator familiarity with the SD K–8 CS Standards, including the 5 core concepts areas, 7 core practices, and 5 AI Big Ideas.

- Foster collaboration and build a supportive network of K–8 educators interested in computer science education.

bit.ly/BHSUCSSD

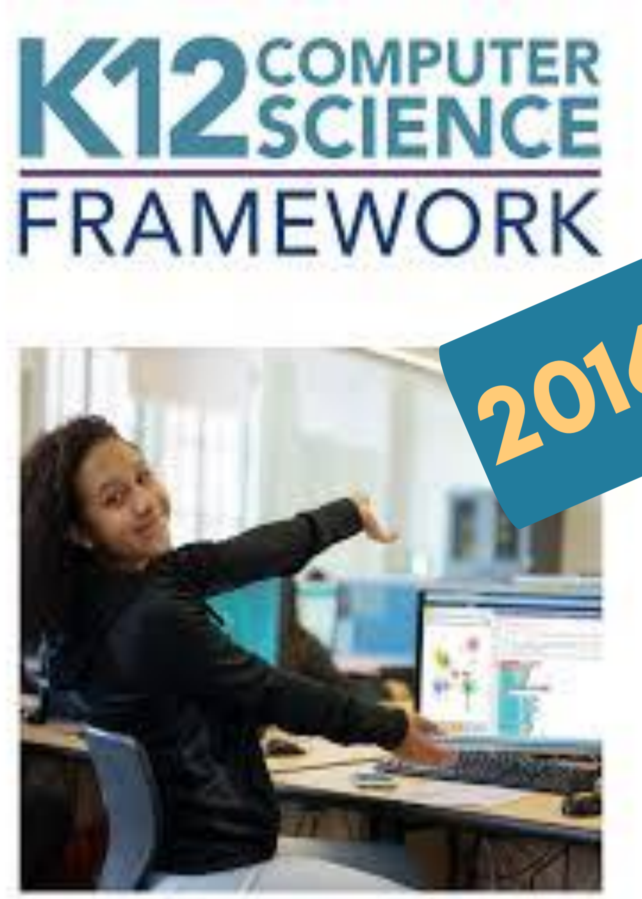
CS Defined by CSTA

(Computer Science Teachers Association)

The study of computers and algorithmic processes, including their principles, their hardware and software designs, their implementation, and their impact on society.

bit.ly/BHSU CSSD

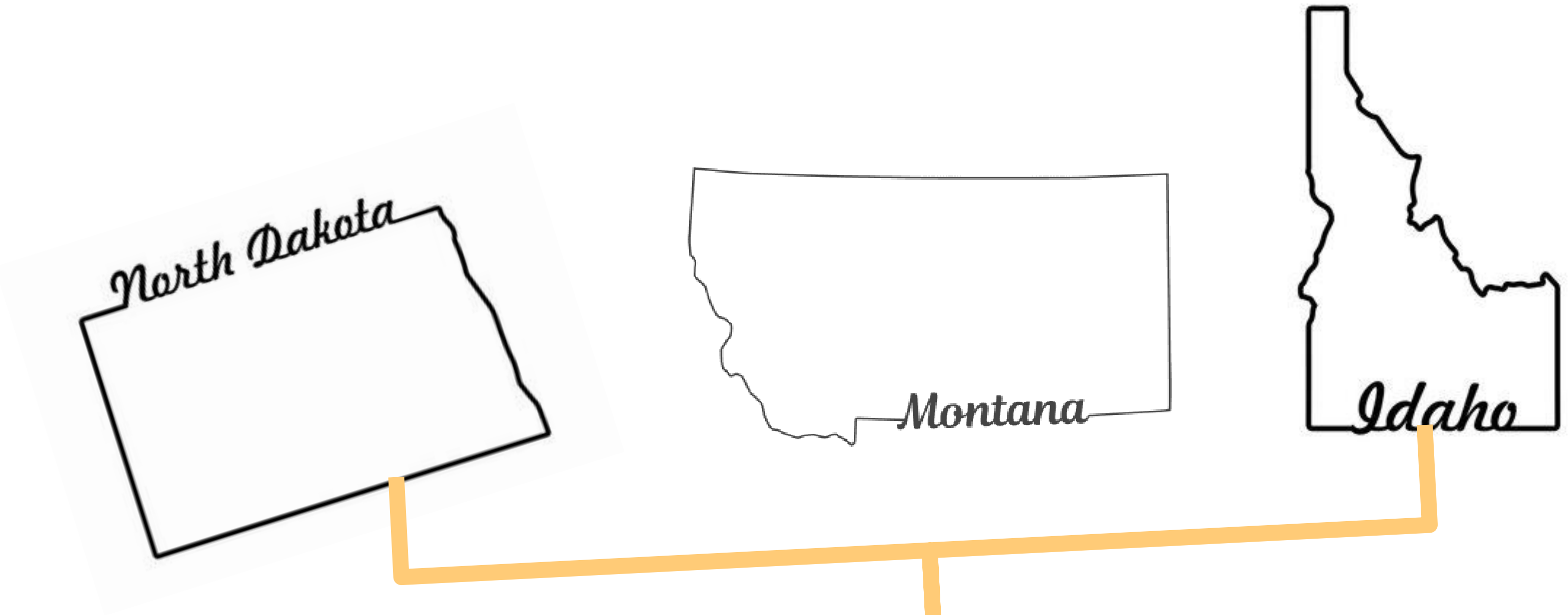
STANDARDS DEVELOPMENT



Computer Science
Teachers Association

K-12 Computer Science St
Revised 2017

2017



south dakota
DEPARTMENT OF EDUCATION
Learning. Leadership. Service.

South Dakota

Computer Science Standards

Adopted April 14, 2025

2024

CS K12 Framework PDF

CS K12 Framework By Concept

Adopted SD K-8 Standards

SD K-12 CS Standards Components

Core Concepts
Fundamental areas of knowledge within CS

Core Practices
Describe how students think and work like computer scientists

AI Big Ideas
Describe how AI systems work, learn, interact, and impact our world

bit.ly/BHSU CSSD

Core Concepts

Algorithms & Programming

Computing Systems

Impacts of Computing

Networks and the Internet

Data Analysis

bit.ly/BHSU
CSSD

Practices 1, 2, and 7: General practices of CS that support computational thinking

Practices 3-6: Computational thinking practices

Math and Science Practices

Mathematics | Kindergarten

Grade K Overview

Counting and Cardinality

- **A.** Know number names and the count sequence
- **B.** Count to tell the number of objects
- **C.** Compare numbers

Operations and Algebraic Thinking

- **A.** Understand addition as putting together and addi o, and understand subtraction as taking apart and ta from.

Number and Operations in Base Ten

- **A.** Work with numbers 11 – 19 to gain foundati place value

Measurement and Data

- **A.** Describe and compare measurable attributes.
- **B.** Classify objects and count the number of objects i ch category.
- **C.** Work with time and money.

Geometry

- **A.** Identify and describe shapes.
- **B.** Analyze, compare, create, and compose shapes

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Important Definitions and Resources

- Fluency – skill in carrying out procedures flexibly, ac ely, efficiently and appropriately.
- Know from Memory – quick, effortless recall of facts. (* Notice there are no Kindergarten standards that require students to "know from memory.")

K-2 Common Addition and Subtraction Situations – Addition and Subtraction Problem Types Chart **(see page 9)**

Science and Engineering Practices (SEP)

1. Asking Questions and Defining Problems
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
6. Constructing Explanations and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information

Framework (2012) p. 41

K-PS2-2	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. (**SEP: 4; DCI: PS2.A; CCC: Cause/Effect**) Alignment may include **K-2-ETS1-1**

K = Kindergarten **PS** = Physical Science **2** = Core Idea 2 **2** = Standard Number

- **SEP: 4** = Science and Engineering Practice: Analyzing and Interpreting Data

Standard Make-Up

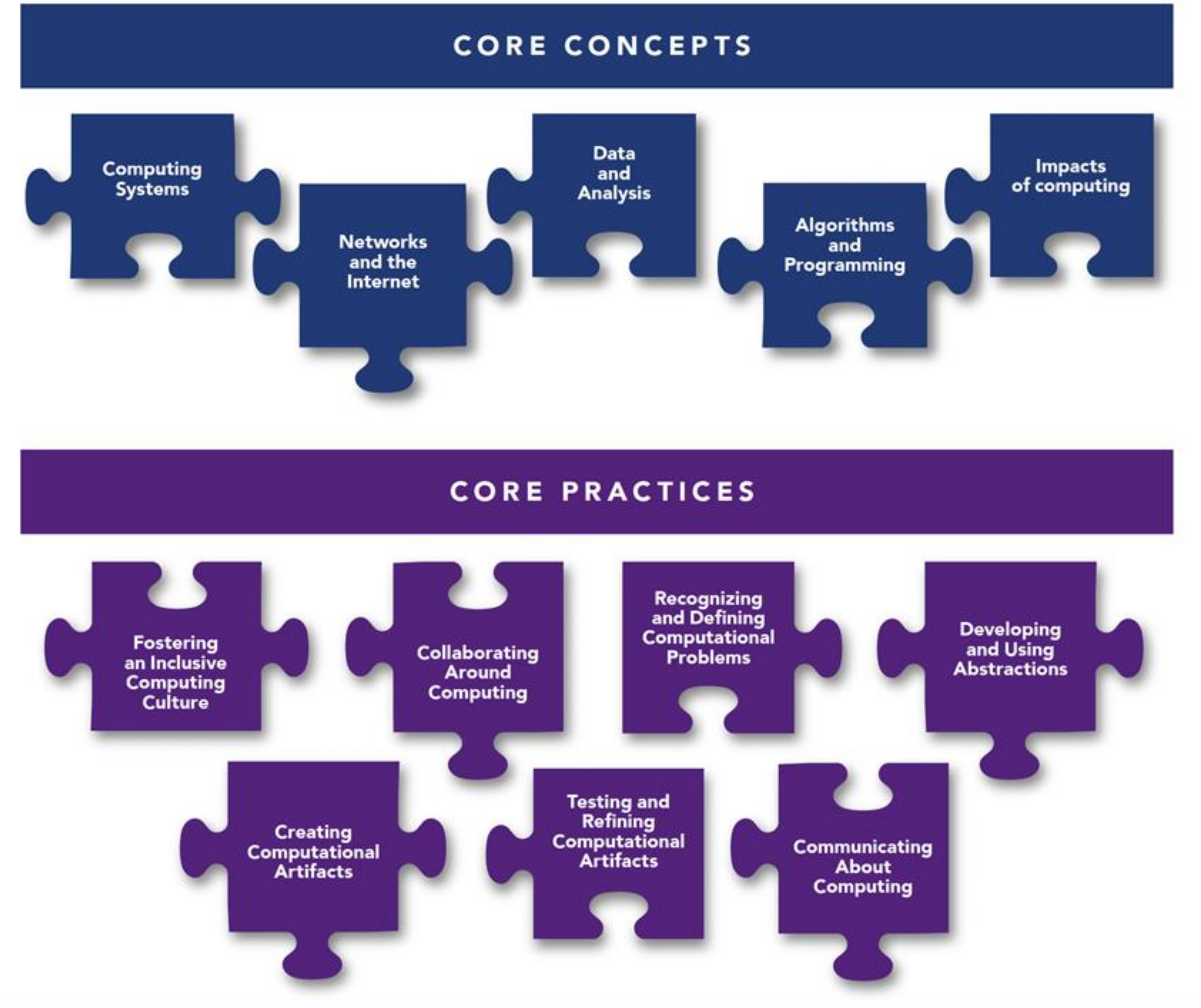
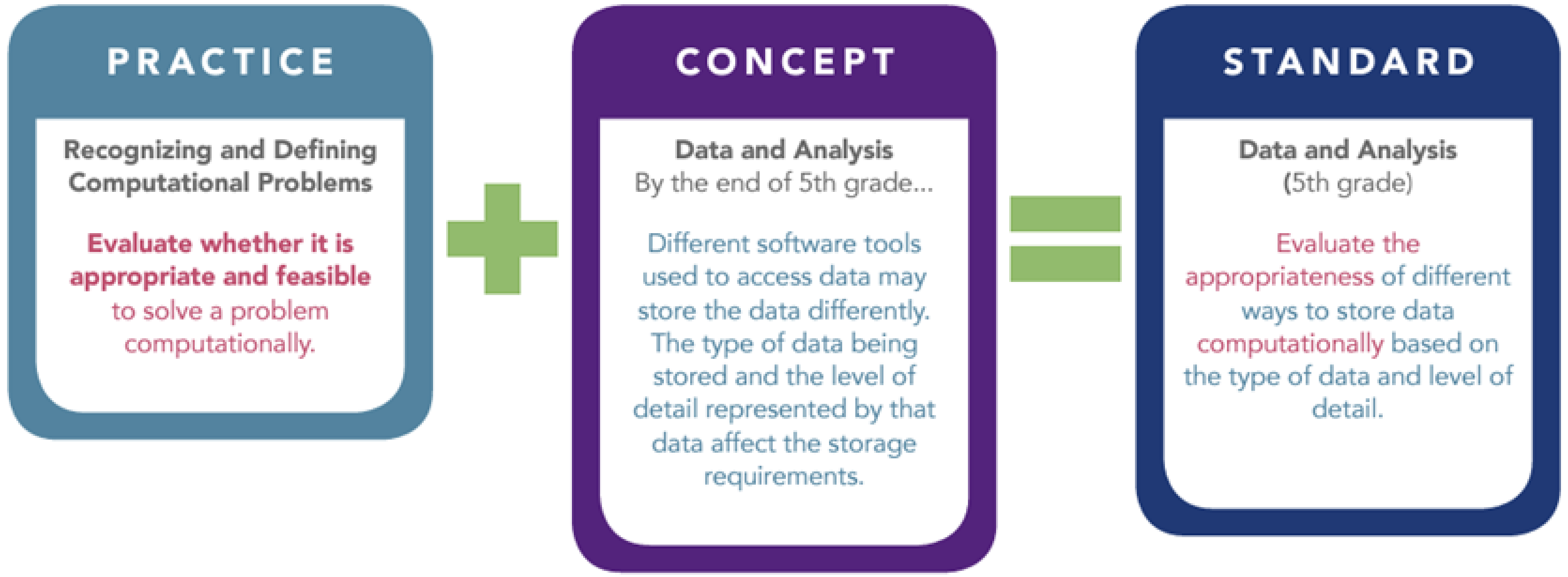
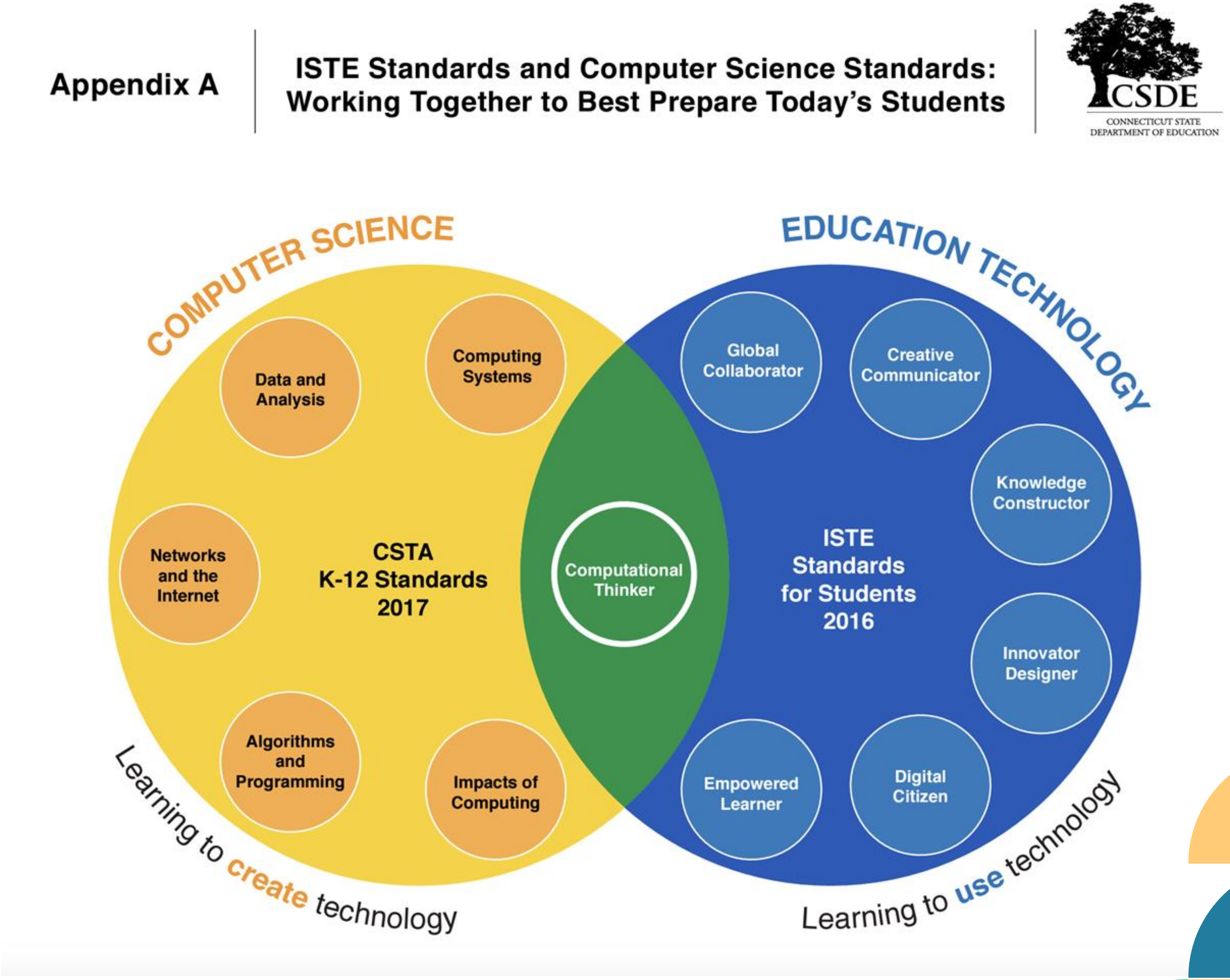


Figure 7.9: Example of integrating a practice and concept to create a standard



CS vs ED Tech Standards



"By default, students are consumers of technology, but they also need to be creators. Being a creator means students are empowered to demonstrate their understanding of technology and to create new technologies that will drive innovation. This also means they'll be prepared for the jobs of the future."

SD K-8 COMPUTER SCIENCE STANDARDS

CORE CONCEPTS ALIGNMENT

Each of the 5 core concepts includes:

- a word cloud created from the standards within that concept
- first (K) and last (8th grade) standard to see the range of skill & knowledge development
- grade banded summaries

Directions: After a few minutes of scanning the core concepts:

- put a **blue dot** on a core concept you feel most **COMFORTABLE** with
- put a **red dot** on one of the core concepts you feel **LEAST** comfortable with

Computational Thinking (CT)

Per the Core Practices #4

CT Defined

A skill set that involves solving problems, defining systems, and understanding human behavior by drawing on the concepts fundamental to computer science.

Wing, J. M. (2006). Computational Thinking. Communications of the ACM, 49(3), 33-35. Retrieved from https://dl.acm.org/doi/10.1145/1118178.1118215

Computational thinking (CT) is a problem-solving process that includes (but is not limited to) the following characteristics:

- Formulating problems in a way that enables us to use a computer and other tools to help solve them.
- Logically organizing and analyzing data
- Representing data through […] models and simulations
- Automating solutions through […] a series of ordered steps
- Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources
- Generalizing and transferring this problem solving process to a wide variety of problems

International Society for Technology in Education & Computer Science Teachers Association. (2011). Operational Definition of Computational Thinking for K-12 Education. https://cdn.iste.org/www-root/Libraries/Documents%20%26%20Files/CT-Operational-Definition-flyer.pdf

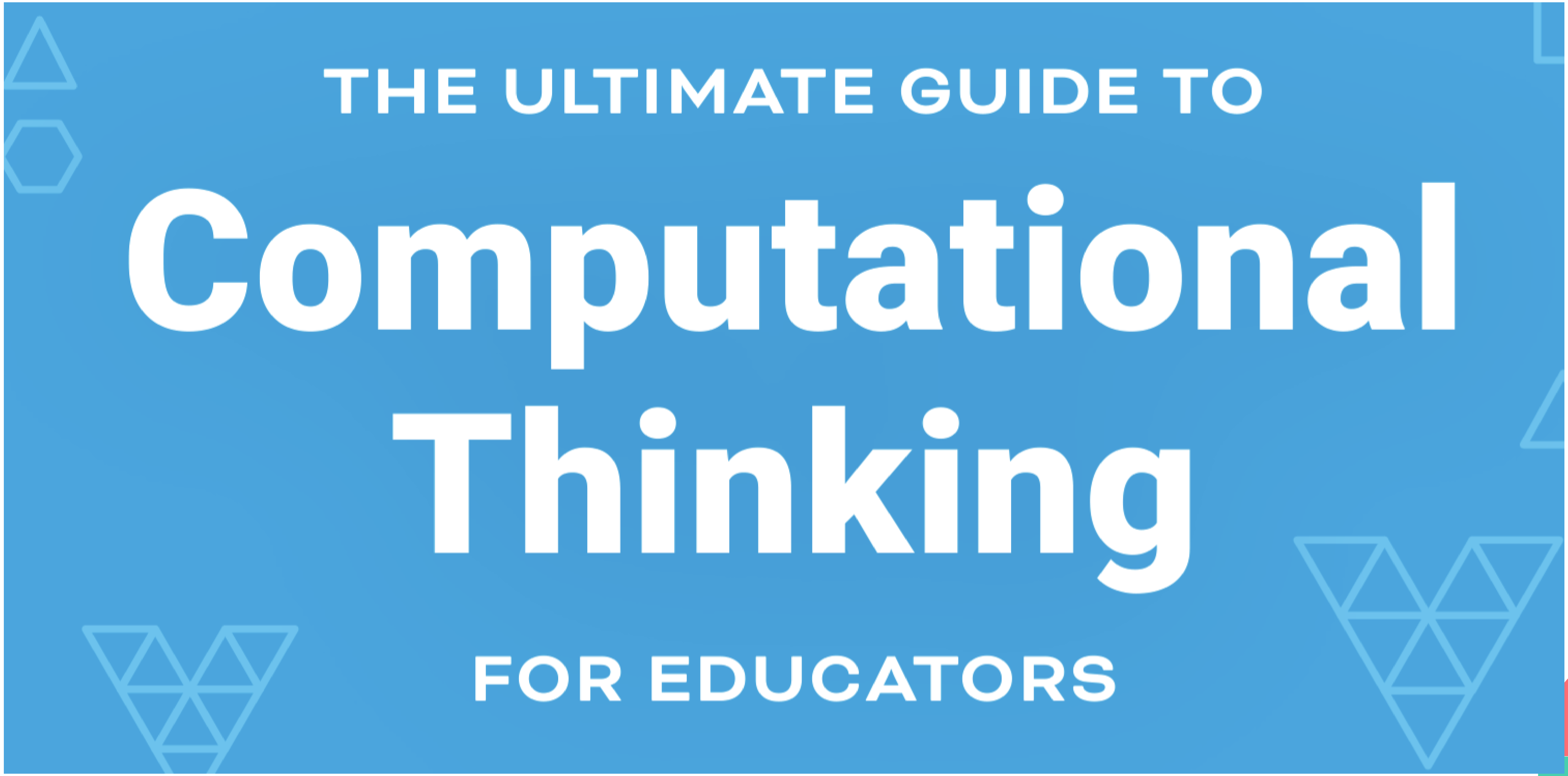

pull-ups

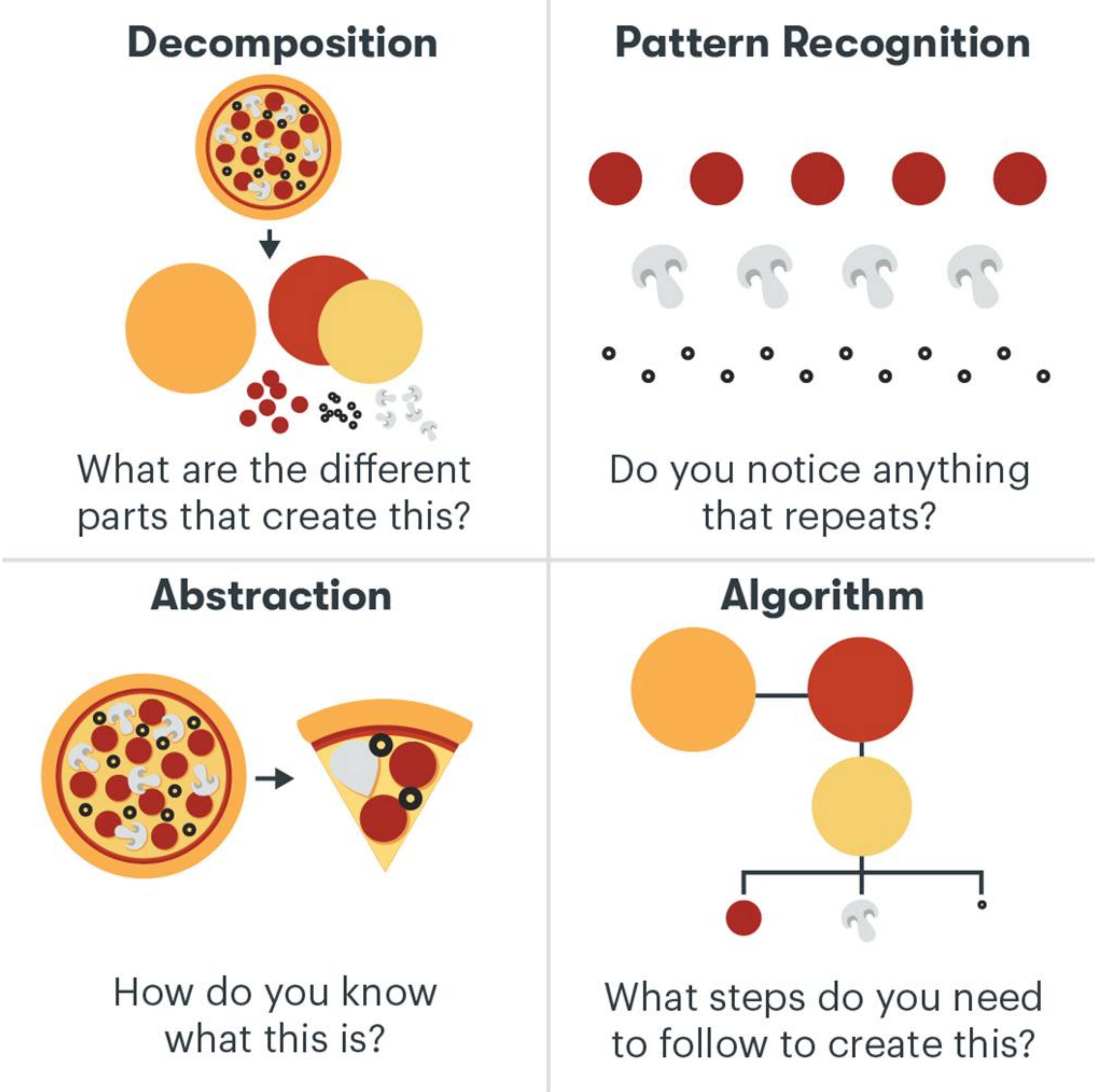
Practices 1, 2, and 7: General practices of CS that support computational thinking

Practices 3-6: Computational thinking practices


4.
Developing and using abstractions, decomposition, pattern recognition, and algorithmic thinking*

Ultimate Guide to CT

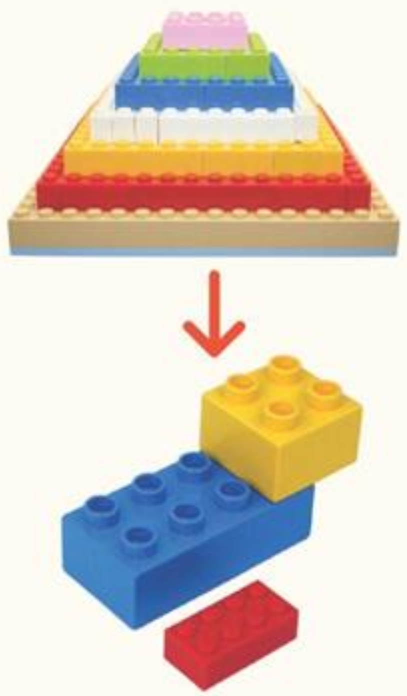



Decomposition
What are the different parts that create this?
Pattern Recognition
Do you notice anything that repeats?
Abstraction
How do you know what this is?
Algorithm
What steps do you need to follow to create this?


pull-ups

DECOMPOSITION

Breaking something down into smaller, more manageable parts



BREAK DOWN:
Take apart /Separate/ Disassemble

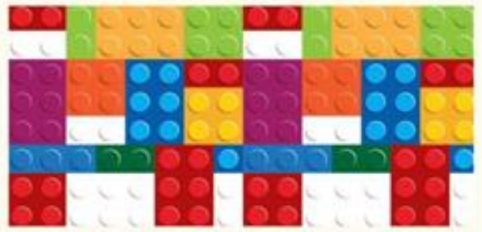
MANAGEABLE PIECES:
Component/ Part/ Element/ Chunk

GUIDING QUESTIONS:
- What are different ways I could break this down?
- What parts are easy? What parts are difficult?
- What are small steps I can take to solve the problem?

English Language Arts	Students analyze themes in a text by first answering: Who is the protagonist and antagonist? Where is the setting? What is the conflict? What is the resolution?
Mathematics	Students find the area of different shapes by decomposing them into triangles.
Science	Students research the different organs in order to understand how the human body digests food.
Social Studies	Students explore a different culture by studying the traditions, history, and norms that comprise it.
Languages	Students learn about sentence structure in a foreign language by breaking it down into different parts like subject, verb, and object.
Arts	Students work to build the set for a play by reviewing the scenes to determine their setting and prop needs.

PATTERN RECOGNITION

Looking for similarities or patterns between things



FIND SIMILARITIES:

Notice/ Observe/ Same/ Alike

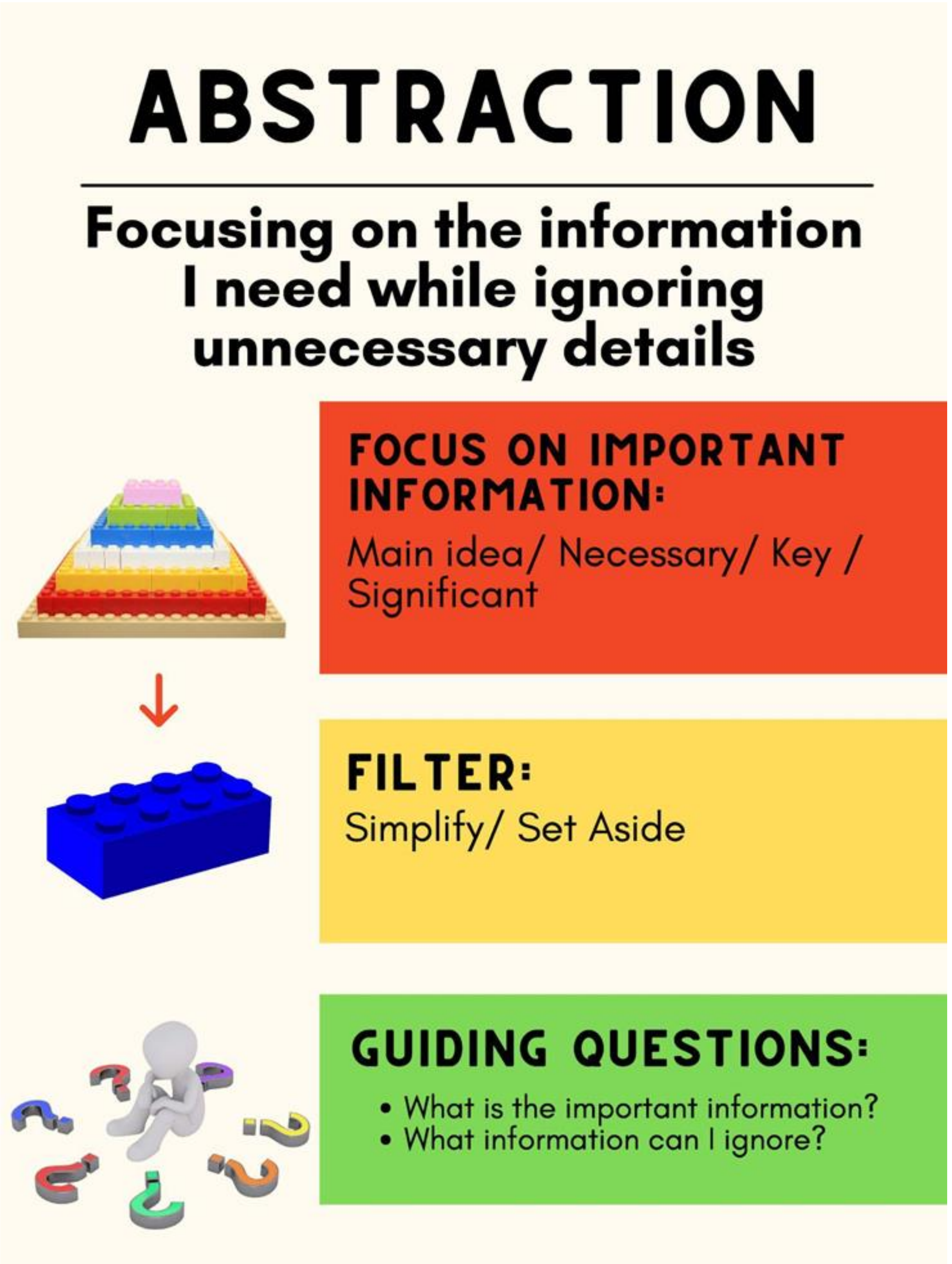
MAKE CONNECTIONS:

Look for repetition

GUIDING QUESTIONS:

- What similarities or patterns do I notice?
- How can I use the pattern to make predictions or draw conclusions?

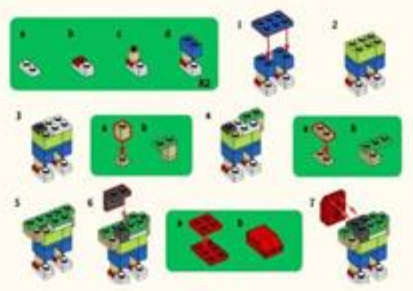
English Language Arts	Students begin to define sonnets based on similarities in separate examples.
Mathematics	Students recognize the specific formulas used to calculate slopes and intercepts.
Science	Students classify animals based on their characteristics and articulate common characteristics for the groupings.
Social Studies	Students identify the potential impact different economic trends reap by looking at data.
Languages	Students group different words in a foreign language by looking at their roots to build a better understanding of vocabulary.
Arts	Students categorize paintings based on commonalities between artists’ aesthetics and detail key characteristics that each grouping presents.



English Language Arts	Students summarize a novel into a book review.
Mathematics	Students conduct a survey of peers and analyze the data to note the key findings, create visualizations, and present the results.
Science	Students develop laws and theorems by looking at similar formulas and equations.
Social Studies	Students coalesce the most important details shared in articles about a current event and write a brief about the event.
Languages	Students create a personal guide that dictates when to use the formal and informal 'you' in Spanish class or the two 'to know' verbs in French, which, mind you, always confounded me.
Arts	Students generalize chord progressions for common musical genres into a set of general principles they can communicate.

ALGORITHMIC THINKING

Developing step-by-step instructions to solve a problem



CREATE A PROCESS:
Define the steps

REFINE THE RULE:
Test/ Evaluate/ Examine/ Finalize

GUIDING QUESTIONS:

- Does my rule work every time?
- Would my instructions be easy for someone else to follow?

English Language Arts	Students map a flow chart that details directions for determining whether to use a colon or dash in a sentence.
Mathematics	In a word problem, students develop a step-by-step process for how they answered the question that can then be applied to similar problems.
Science	Students articulate how to classify elements in the periodic table.
Social Studies	Students describe a sequence of smaller events in history that precipitated a much larger event.
Languages	Students apply new vocabulary and practice speaking skills to direct another student to perform a task, whether it's ordering coffee at a café or navigating from one point in a classroom to another.
Arts	Students create instructions for drawing a picture that another student then has to use to recreate the image.

AI Big Ideas

NATIONAL ARTIFICIAL INTELLIGENCE ACT OF 2020

"The term 'artificial intelligence' means a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments."

CODE.ORG

Artificial Intelligence (AI) - when a machine acts in ways that mimic human intelligence such as playing a game, creating works of art, having a conversation, performing routine tasks, or solving problems.

International Journal of Research, Publications, & Review

AI is a broad scientific field encompassing the development of systems that can exhibit behaviors we consider intelligent in humans, such as learning and decision-making. This encompasses tasks like logical reasoning, understanding language, and solving complex problems.

The AI4K12 Initiative is a joint project of:

AAAI Association for the Advancement of Artificial Intelligence

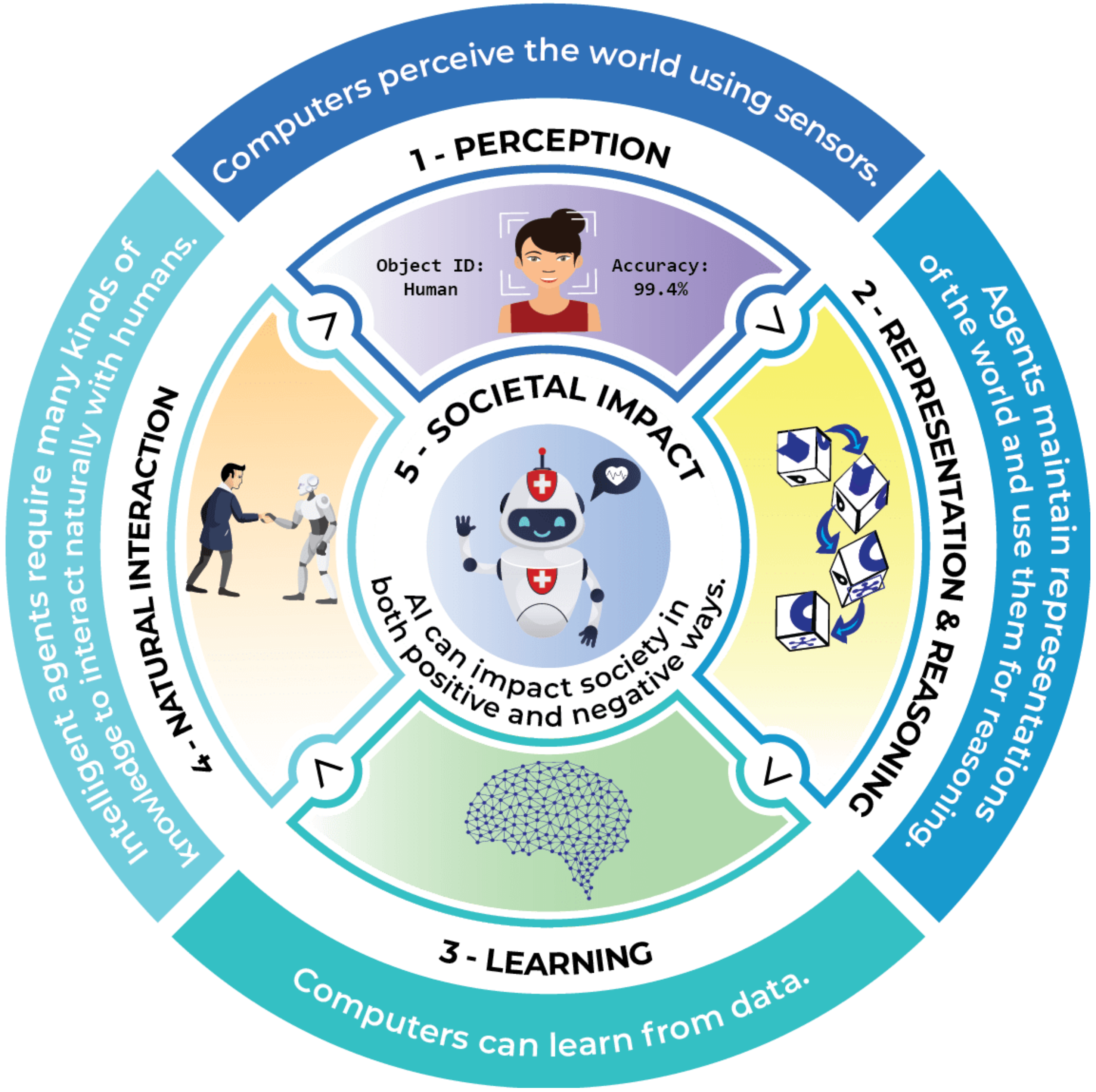
CSTA

Generously funded by

National Science Foundation ITEST Program (DRL-1846073)

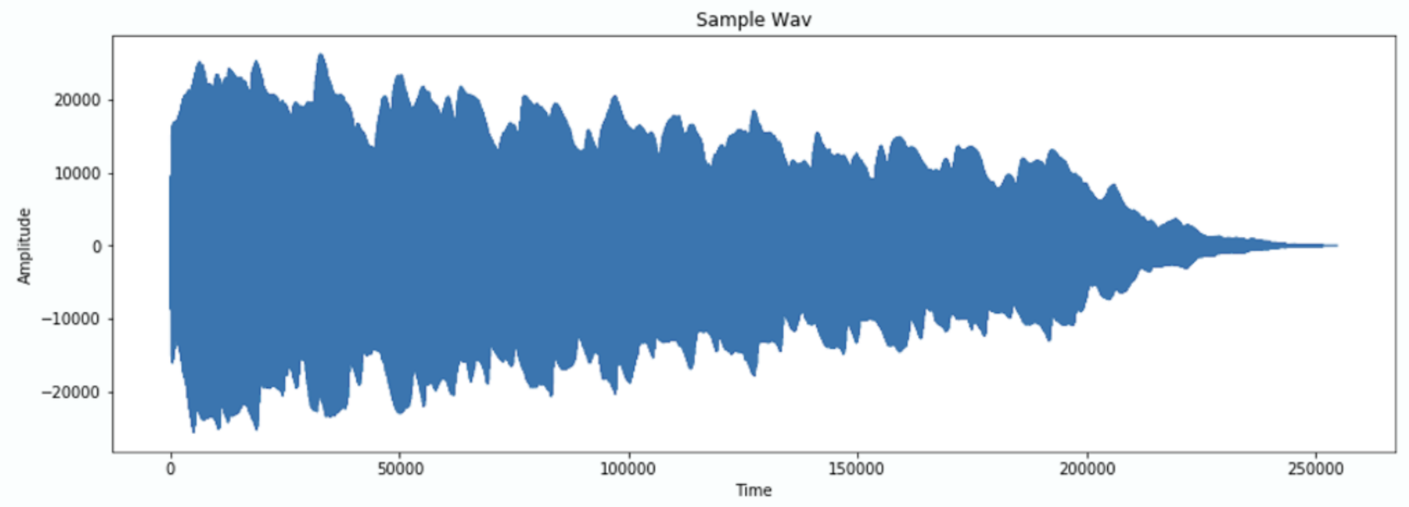
Carnegie Mellon University School of Computer Science

5 AI4K12 Big Ideas

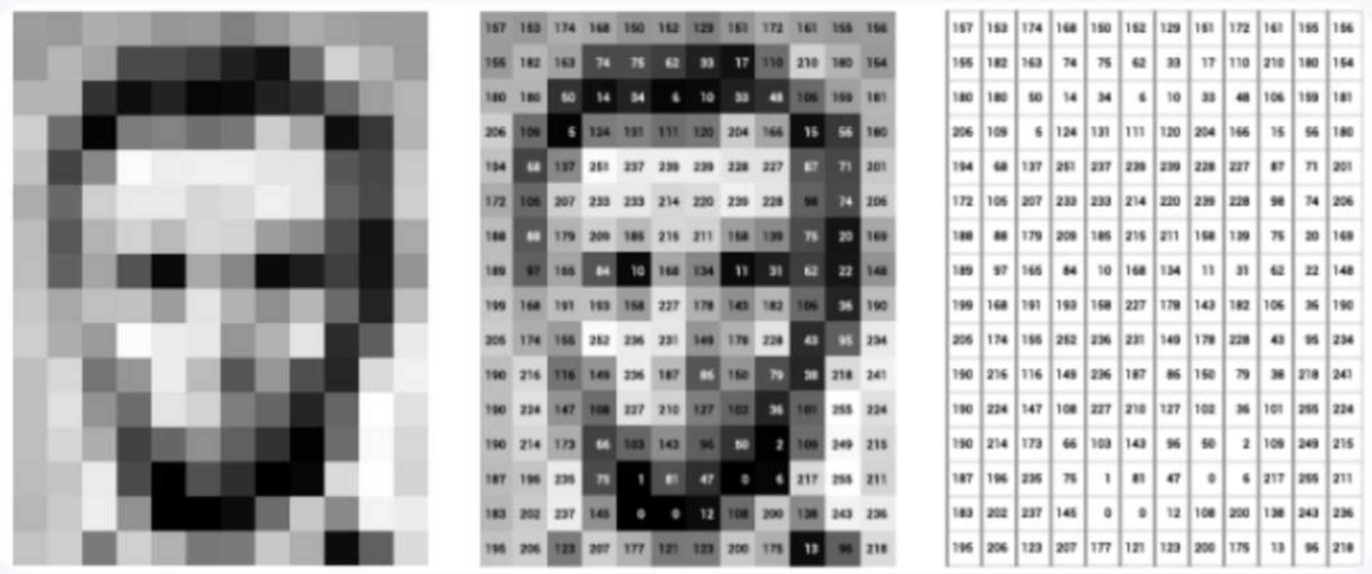


Representation & Reasoning

Representation means using **data structures** (like charts, graphs, decision trees, or databases) to create a picture of a problem or world.
Reasoning means using **algorithms** or rules to draw conclusions from that picture—like predicting the next move in a game or determining the best driving route.



An example of a waveform. Source: Audio Singal Processing for Machine Learning



bit.ly/BHSU
CSSD

Draft Big Idea 2 - Progression Chart

Big Idea #2: Representation & Reasoning

Key Insights	Explanation
Representations are data structures; reasoning methods are algorithms.	Artificial intelligence uses the tools of computer science: data structures and algorithms.
Representations support reasoning; reasoning methods operate on representations.	Representation and reasoning are mutually dependent.
The two major types of knowledge representations are symbolic and numerical representations.	Reasoning with symbolic representations is performed using logical inference rules, while reasoning with numerical representations utilizes complex mathematical functions such as neural networks.
"Knowing" something means the ability to both represent it and reason with it.	Books and videos can represent knowledge but they don't "know" things because they can't make use of that knowledge.
Agents are considered intelligent if they employ a non-trivial sense-deliberate-act cycle to make progress toward achieving their goals.	To be considered intelligent, at least one of the sense, deliberate (reason), or act components must require computational sophistication or signifcant computing power. Garage door openers are not intelligent agents because their sensing, reasoning, and action are all trivial.

Your phone unlocks when it sees your face.

1 - Perception

2 – Representation & Reasoning

3 - Learning

4 – Natural Interaction

05 – Social Impact

Students, drag the icons!

You receive movie suggestions based on your viewing history.

1 - Perception

2 – Representation & Reasoning

3 - Learning

4 – Natural Interaction

05 – Social Impact

Google Maps updates your route based on traffic patterns.

1 - Perception

2 – Representation & Reasoning

3 - Learning

4 – Natural Interaction

05 – Social Impact

A chatbot helps you order food online using natural language.

1 - Perception

2 – Representation & Reasoning

3 - Learning

4 – Natural Interaction

05 – Social Impact

You wonder if an AI hiring tool might favor certain candidates unfairly.

1 - Perception

2 – Representation & Reasoning

3 - Learning

4 – Natural Interaction

05 – Social Impact

Students, drag the icons!

K-2.AP.01: Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks (with or without devices).

1 – Perception

2 – Representation & Reasoning

3 – Learning

4 – Natural Interaction

05 – Social Impact

Students, drag the icons!

3-5.AP.02: Create programs that use variables to store and modify data.

1 - Perception

2 – Representation & Reasoning

3 - Learning

4 – Natural Interaction

05 – Social Impact

Students, drag the icons!

3-5.IC.02: Identify limitations and possible solutions relating to accessibility and usability of technology products for the varied needs and wants of users.

1 - Perception

2 – Representation & Reasoning

3 - Learning

4 – Natural Interaction

05 – Social Impact

Students, drag the icons!

6-8.CS.02: Design projects that combine hardware and software components to collect and exchange data.

1 – Perception

2 – Representation & Reasoning

3 – Learning

4 – Natural Interaction

05 – Social Impact

It’s time to rethink “plagiarism” and “cheating”

Which of these would you consider “cheating”?

Which of these is relevant to our students’ future?

Which of these would you use in your work as an adult?

Bot-created

- Student plugged prompt into AI, copied response and submitted it to teacher.
- AI created a response. Student read, edited, adjusted, and submitted.
- Student created multiple AI responses, used the best parts, edited, and submitted.
- Student wrote main ideas. AI generated a draft and offered feedback to improve.
- Student consulted internet/AI for ideas, then wrote and submitted.
- Student wrote all assignment content without consulting AI or the internet.

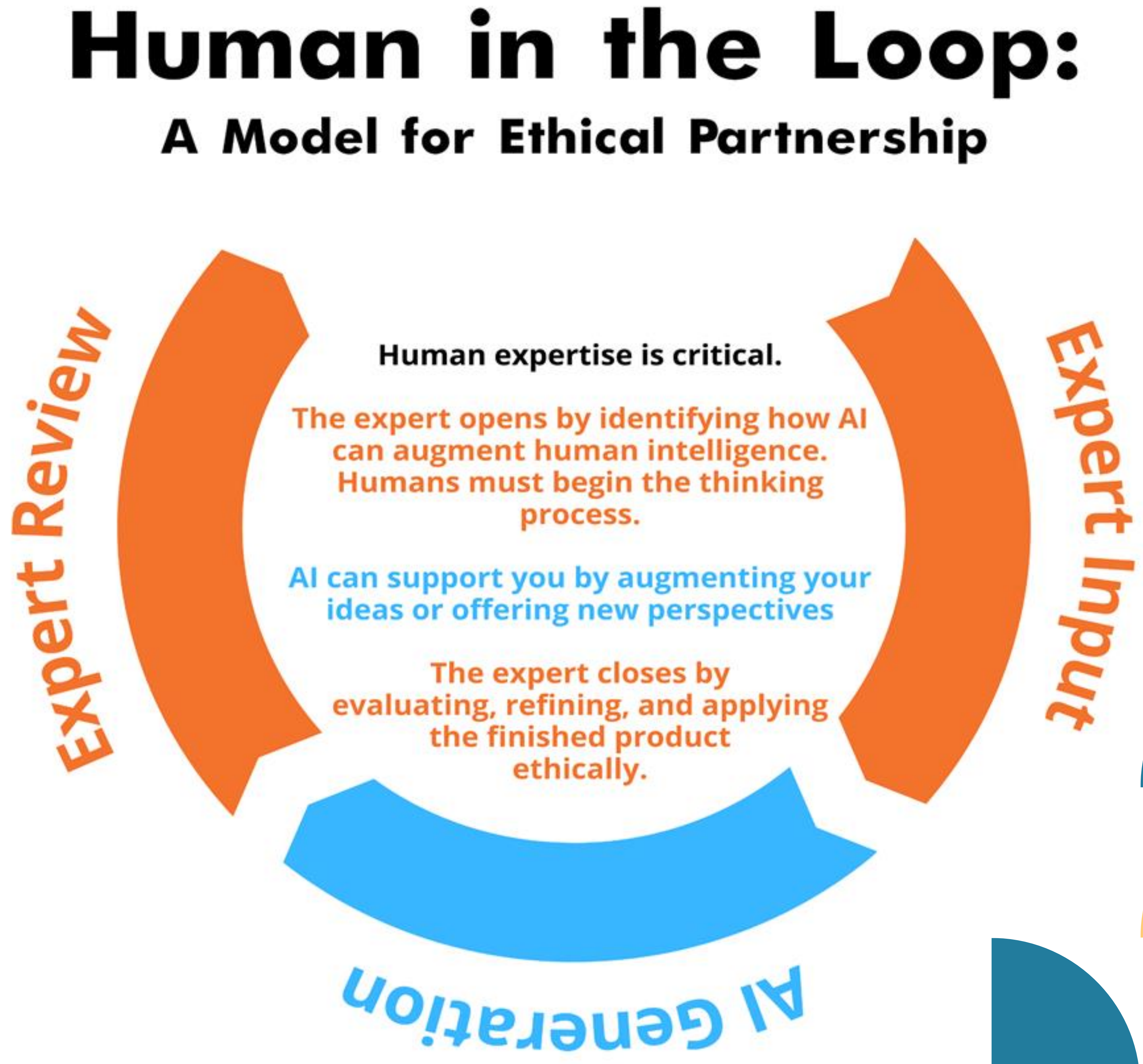
Student-created

DITCH THAT TEXTBOOK

Graphic by Matt Miller (@jmattmiller) DitchThatTextbook.com

Students, drag the icon!

- DSU President Jose-Marie Griffiths
  - Commissioner for the National Security Commission on Artificial Intelligence
  - Proponent of the Human in the Loop approach



AI for Education

How to Use AI Responsibly EVERY Time

EVALUATE the initial output to see if it meets the intended purpose and your needs.

VERIFY facts, figures, quotes, and data using reliable sources to ensure there are no hallucinations or bias.

EDIT your prompt and ask follow up questions to have the AI improve its output.

REVISE the results to reflect your unique needs, style, and/or tone. AI output is a great starting point, but shouldn't be a final product.

YOU are responsible for everything you create with AI. Always be transparent about how you've used these tools.

aiforeducation.io

Challenges with AI and potential problems

Mistakes and bias

AI systems can make errors or be biased if trained on flawed data. It's also not always accurate and must be fact-checked.

Privacy concerns

AI systems often collect and analyze personal information. They're learning a lot of info about us all. This raises questions about data privacy and security.

Unhealthy dependence

Over-reliance on AI might reduce critical thinking and problem-solving skills. We might get used to letting AI do all the "thinking" for us.

Misinformation and distorting reality

AI can produce fake photos and videos, making it hard to know what is really true.

Intellectual property issues

AI scrapes content from the internet, often without crediting its sources. Writers, photographers, and artists may not like having their ideas taken by AI.

What would you add?

Andgela Watson's Truth for Teachers

Students, drag the icons!

How to Determine When AI is Okay to Use for Assignments

Level	Type of AI Use	Student Role	Examples
No AI 0	No AI involvement	Independent work required	Complete the entire task on your own
AI for Brainstorming and Editing 1	Minimal AI use for idea generation or editing	AI assists with early ideas and edits	Brainstorming project topics, grammar checking, proofreading, or suggesting word changes
AI for Specific Tasks 2	AI handles specific tasks the teacher permits and is cited as a source	Collaborative: AI completes specific tasks and the student does the rest	Summarizing sources, generating visuals or data, using AI-generated content with proper citation
Full Use of AI 3	Major AI contribution to the work	AI does a large part of the work and is cited	AI-written essays, AI-designed projects, AI-created images, all fully disclosed and cited

Andgela Watson's Truth for Teachers df

Matt Miller #TCEA23 🤠
@jmattmiller · **Follow**

Calculators.
Search engines.
Google Translate.
Wikipedia.
PhotoMath.
#ChatGPT.

They disrupt traditional teaching.

We adapt. Education evolves forward.

Blocking them isn't the answer.

Making education more relevant is.

7:59 AM · Dec 14, 2022

❤ 350 Reply Share this Tweet

Reversed Post-It Discussion

Understanding the Landscape

- What questions do you have about the SD K-8 Computer Science standards?
- What does Computer Science education currently look like in your classroom, school, or district?
- How would you describe the overall climate for technology and CS adoption in your district?

Assessing Current Capacity and Needs

- What existing resources or supports are helping you or your colleagues implement CS instruction?
- What additional supports or changes would most help your school meet the CS standards?

Looking Toward the Future

- What are your hopes for how students will benefit from high-quality CS education?
- How do you imagine our world will change as more students receive foundational CS education from an early age?

Ending Questions

Wrap-up Discussion

- **What insights or surprises emerged during the share-out that challenged or expanded your thinking?**
- **As participants in this workshop, what could be specific next steps that you could take to advance CS or tech integration in your context?**
- **From your perspective, what should be the next step for those of us who work to support educators and systems?**
  - *Think about professional development, policy alignment, advocacy, or resource development.*
- **Looking at the conference as a whole, what key ideas, challenges, or themes have stood out most to you?**

THANK YOU

Reach out with questions or thoughts!

- *Nicole.uhrebalk@bhsu.edu*
- *Hannah.caffee@bhsu.edu*