Computational Thinking Routines for K-5 ELA

Summary

With support from the Robin Hood Learning + Technology Fund, The Leadership Academy, and Learning Heroes, Digital Promise worked collaboratively to explore the integration of computational thinking (CT) and blended literacy in NYC elementary schools while centering inclusive pedagogies. In the 2023–2024 school year, we engaged with P.S. 344 AmPark Neighborhood School and P.S. 125 The Ralph Bunche School to work directly with their students, families, educators, and school leaders. Digital Promise's key role was teacher focused, engaging a cohort of seven K-5 English Language Arts (ELA) educators to explore the integration of CT in ELA. This project aims to increase knowledge-sharing and collaboration among the schools and the communities they serve, building capacity for inclusive CT and blended literacy learning, especially for marginalized students. Given New York City Public Schools (NYCPS) is focused on fostering digital fluency for all students and is committed to effective literacy instruction, this toolbox demonstrates how educators can leverage the synergies of CT and ELA to enhance student outcomes.

Partner School #1:

P.S. 344 AmPark Neighborhood School

AmPark is a school that celebrates their diverse student population nestled in the Bronx. They have a strong emphasis on project-based learning and family engagement.

- District: 10
- Grades: PK-5
- Participating Teachers: K-2 SPED Teacher, Fourth Grade Teacher, Fifth Grade ELA Teacher
- Student Enrollment: 290

Partner School #2:

P.S. 125 The Ralph Bunche School

P.S. 125 is in the heart of Harlem and maintains authentic community partnerships. They are committed to instilling social justice in their students.

- District: 5
- Grades: PK-5
- Participating Teachers: 2 K-5 Literacy Coaches, Third Grade Teacher, Fifth Grade ELA Teacher
- Student Enrollment: 225

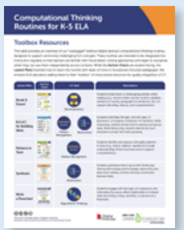
Process

Over four professional development sessions and other engagement touchpoints, teachers built an understanding of CT and thought deeply about its relevance in ELA skills and practices. This sparked a participatory design process to develop a toolbox of resources to support the integration of CT skills in literacy as "Computational Thinking Routines." These routines were designed to invoke metacognition by providing concrete steps in visualizing thinking processes with the goal of addressing commonly challenging ELA concepts. With participating teachers, Digital Promise designed student-facing Anchor Charts and complementary Lesson Plans which provide more insight on inclusive pedagogies.

Toolbox Resources

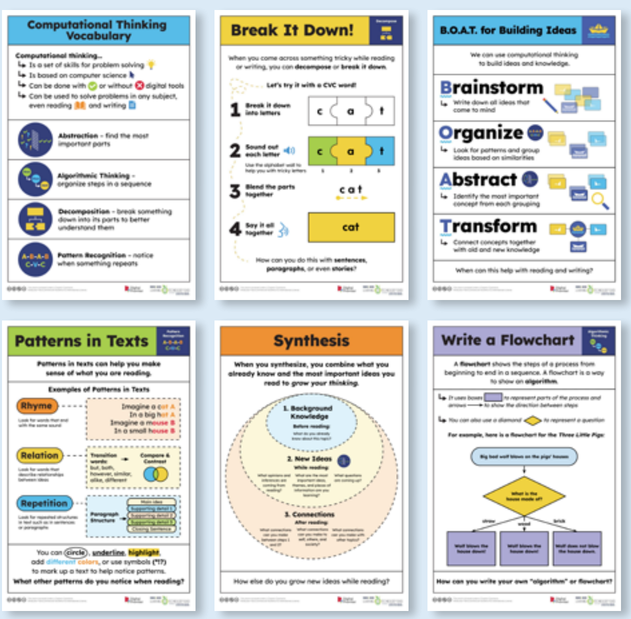
Content for the toolbox includes the following:

Computational Thinking Routines for K-5 ELA Toolbox Resources (Table)



Computational Thinking ELA Student Look Fors (Table)

Anchor Charts
(8.5 X 11 inches and 24 X 36 inches)



Lesson Plans as illustrative examples of how to implement Anchor Charts in the classroom

Learn more at digitalpromise.org/CT_ELA

Computational Thinking Routines for K-5 ELA

What Is Computational Thinking?

Computational thinking (CT) is a problem-solving approach that can be applied across disciplines and in everyday life. Although CT is based on concepts fundamental to computer science, its application is broader than just "plugged" coding on digital devices. CT contributes to 21st-century skills, equipping students to lead successful lives as technology evolves and becomes more integrated in our world. In the table below are definitions for the CT skills applied in routines:

Abstraction
Filtering aspects of a problem or phenomenon for what is most important

Algorithmic Thinking
Organizing steps in an ordered sequence

Decomposition
Dividing problems into smaller parts to better understand them

Pattern Recognition
Recognizing recurring features, data, or relationships

Relevance to ELA

CT provides learners with a skill set that promotes metacognition and enables problem-solving across subject areas and contexts. While CT is typically associated with math or science, there are benefits to integrating CT in all disciplines, including ELA. For example, the CT routines described on the next page support learners to engage in English Language Arts skills such as decoding and synthesis.

Inclusive Pedagogies

What does inclusive CT look like in a classroom? The pedagogies are divided into three categories listed below to emphasize different pedagogical approaches to inclusivity:

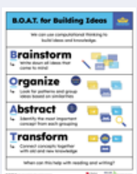
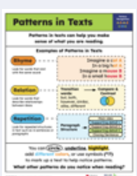
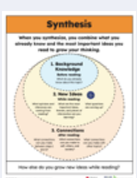
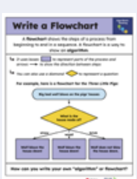
- **Designing Accessible Instruction** refers to strategies to engage all learners in computing.
- **Connecting to Students' Interests, Homes, and Communities** refers to drawing on the experiences of students to design learning experiences that are connected with their homes, communities, interests and experiences to highlight the relevance of computing in their lives.
- **Acknowledging and Combating Inequity** refers to a teacher supporting students to recognize and take a stand against the oppression of marginalized groups—in society broadly and in computing specifically.

The lesson plans linked on the next page share more on how to actualize inclusive pedagogies when implementing our Computational Thinking Routines for K-5 ELA Toolbox Resources.

Computational Thinking Routines for K-5 ELA

Toolbox Resources

This table provides an overview of our "unplugged" (without digital devices) computational thinking routines designed to support commonly challenging ELA concepts. These routines are intended to be integrated into instruction regularly so that learners are familiar with the problem-solving approaches and begin to recognize when they can use them independently across contexts. While the **Anchor Charts** are student facing, the **Lesson Plans** illustrate how to teach the routine with ideas on how to incorporate inclusive pedagogies. We envision ELA educators adding these to their "toolbox" of instructional resources for quality integration of CT.

Lesson Plan	Anchor Chart	CT Skill	Description
Break It Down!		Decomposition	Students break down a challenging problem while reading (e.g., word to letter sounds, word to syllables, sentence to words, paragraphs to sentences, etc.) to support decoding, fluency, and comprehension.
B.O.A.T. for Building Ideas		Pattern Recognition Abstraction	Students build ideas through concrete steps: 1) Brainstorm, 2) Organize, 3) Abstract, 4) Transform. While Organizing, students should look for patterns and group ideas. While Abstracting, students identify the most important concept from each grouping.
Patterns in Texts		Pattern Recognition	Students identify and express noticeable patterns in texts (e.g., rhyme, relation, repetition) to build understanding of text structures and to support comprehension.
Synthesis		Abstraction	Students synthesize texts to grow their thinking by starting with background knowledge, abstracting new ideas from reading, and then forming connections between ideas.
Write a Flowchart		Algorithmic Thinking	Students engage with the logic of a sequence and internalize the cause-effect relationship of ordered steps by writing a story, narrative, or process as a flowchart.

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Computational Thinking K-5 ELA

Student Look Fors

CT Skill	ELA Look Fors Leveraging CT Skills
Abstraction Filtering aspects of a problem or phenomenon for what is most important	• Identify the theme or main idea of a story • Classify and sort letters, letter sounds, rhyming words, sentence strips, etc. • Identify key components of a writing prompt to respond appropriately • Collect data/information from texts and organize for the most significant points
Algorithmic Thinking Organizing steps in an ordered sequence	• Write explanatory texts such as a "how-to" article or "recipe" for everyday tasks • Sequence key events in a story, acknowledging that the order impacts the logic of events (e.g., plant a seed before picking its flower) • Write a flowchart or decision tree as a "choose-your-own-adventure" story
Decomposition Dividing problems into smaller parts to better understand them	• Breaking up a word into parts to help read with fluency • Dividing up a sentence into parts of speech • Highlighting different paragraphs and topic sentences to identify components of essay structure (e.g., Painted Essay™)
Pattern Recognition Recognizing recurrent features, data, or relationships	• Develop awareness of patterns in decoding text (e.g., patterns in reading words with long vs. short vowels) • Identify patterns in text structures to extend the text (e.g., adding a section to "We're Going on a Bear Hunt" or adding a stanza to a poem) • Identify patterns in a story to predict what happens next

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