FOUNDATIONAL THINKING

A Unified PreK–2 Strategy for Literacy, Mathematics, and Future-Ready Learning

District Briefing for Superintendents and Curriculum Leaders
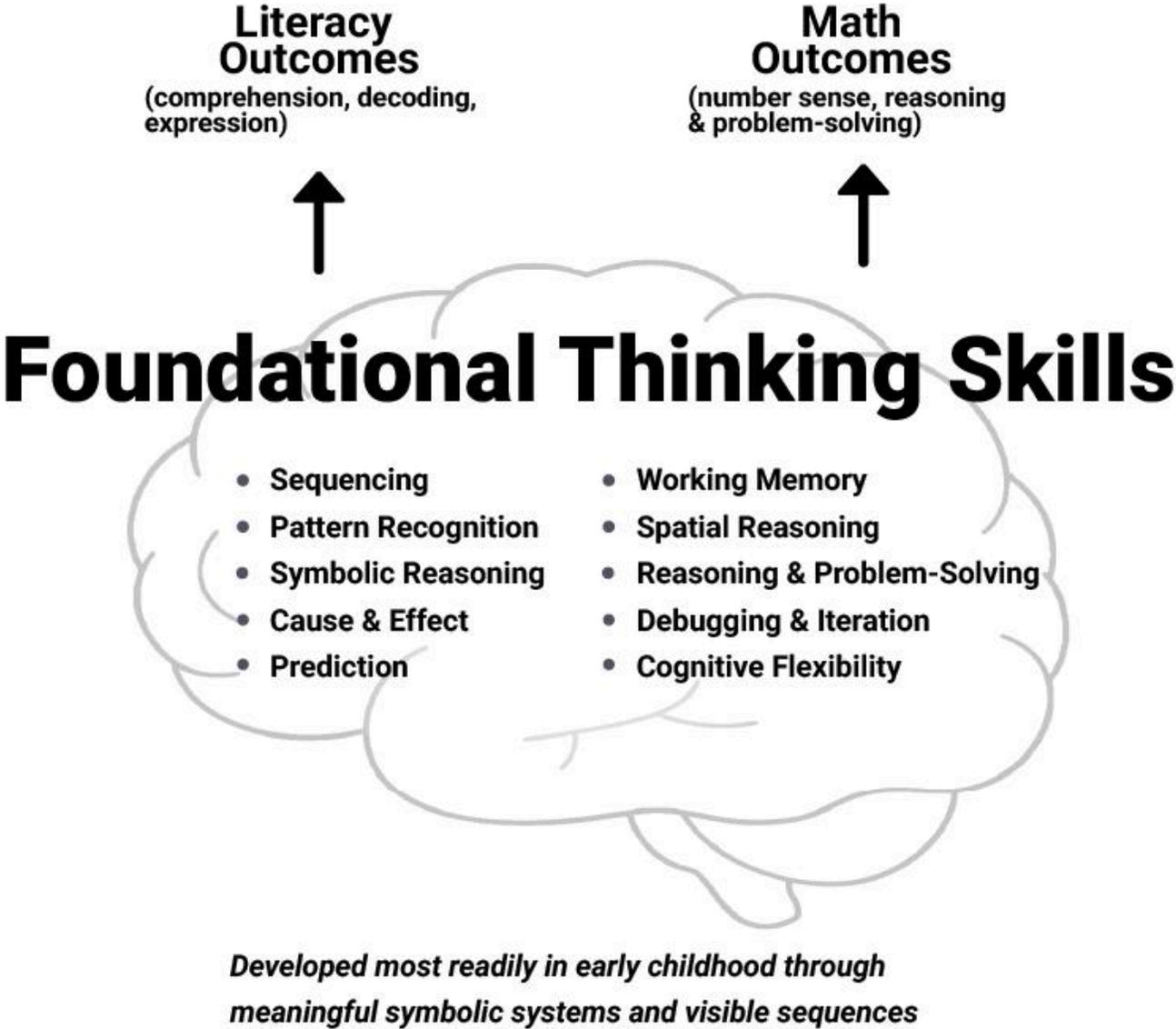

Literacy Outcomes
(comprehension, decoding, expression)

Math Outcomes
(number sense, reasoning & problem-solving)

Foundational Thinking Skills

- Sequencing
- Pattern Recognition
- Symbolic Reasoning
- Cause & Effect
- Prediction

- Working Memory
- Spatial Reasoning
- Reasoning & Problem-Solving
- Debugging & Iteration
- Cognitive Flexibility

Developed most readily in early childhood through meaningful symbolic systems and visible sequences

Figure 1: The Ten Foundational Thinking Skills © 2026 Codie Blocks

EXECUTIVE SUMMARY

The Challenge Facing Districts
Schools are being asked to raise literacy and math outcomes, introduce computational thinking, prepare students for an AI-driven world, and do so without increasing instructional burden. These goals are often pursued through separate initiatives. Research increasingly suggests these challenges may share a common underlying cognitive foundation.

Three well-established findings from developmental science help explain this opportunity.

First, longitudinal research shows that executive function skills such as working memory, attention control, and cognitive flexibility strongly predict later reading and mathematics outcomes (Blair & Razza, 2007; Duncan et al., 2007).

Second, research in cognitive development shows that literacy and mathematics draw on shared underlying cognitive systems rather than independent learning pathways (Welsh et al., 2010).

Third, these domain-general capacities develop rapidly during the preschool and early elementary years, when executive control systems in the brain are maturing quickly.

Taken together, these findings suggest that strengthening these foundational cognitive capacities early may improve learning across multiple academic domains.

Research on early literacy has clarified key components of effective reading instruction, including phonemic awareness, phonics, fluency, vocabulary, and comprehension. Foundational Thinking focuses on the underlying cognitive capacities that help children engage successfully with literacy and mathematics learning, including sequencing, working memory, symbolic reasoning, and cognitive flexibility.

These capacities develop rapidly during the preschool years, when executive function systems such as working memory, attention control, and cognitive flexibility are maturing quickly. Developmental research consistently links growth in these skills during early childhood to later literacy and mathematics outcomes (Blair & Razza, 2007; Duncan et al., 2007). Strengthening them can help students engage more effectively with literacy and mathematics instruction while building the broader reasoning and problem-solving skills that underpin later academic learning.

The Core Insight
The cognitive skills that support reading, mathematics, and problem-solving are deeply interconnected. Longitudinal research shows that domain-general capacities such as executive function, attention control, and symbolic reasoning predict later academic outcomes across multiple subjects (Duncan et al., 2007; Welsh et al., 2010). Rather than operating independently, literacy and mathematics draw on shared cognitive systems. When districts intentionally

strengthen these skills in PreK–2, they strengthen literacy and mathematics outcomes simultaneously. Foundational Thinking is the shared cognitive infrastructure beneath literacy, mathematics, and problem-solving.

What is Foundational Thinking

Foundational Thinking is a synthesis of well-established findings from developmental science describing the cognitive capacities that support learning across literacy, mathematics, and problem-solving. These skills begin developing before children become fluent readers and continue strengthening alongside literacy and mathematics instruction, and are increasingly associated in research with later academic outcomes. They are not separate from literacy and math. They are the shared cognitive base beneath both.

The 10 Foundational Thinking Skills

	Literacy Foundations			Math Foundations		
	Reading Comprehension	Decoding	Expression	Conceptual Understanding	Number Sense	Reasoning & Problem-Solving
Sequencing	✓	✓	✓	✓	✓	✓
Pattern Recognition		✓		✓	✓	✓
Symbolic Reasoning		✓	✓	✓	✓	✓
Cause & Effect	✓		✓	✓		✓
Prediction	✓		✓	✓	✓	✓
Working Memory	✓	✓	✓	✓	✓	✓
Spatial Reasoning		✓		✓		✓
Logic & Problem-Solving	✓		✓	✓		✓
Debugging & Iteration	✓		✓	✓		✓
Cognitive Flexibility	✓		✓	✓		✓

Figure 2: Table 1. Foundational Thinking Skills and Academic Outcomes © 2026 Codie Blocks

Why This Matters for Districts
Early childhood organizations increasingly describe computational thinking for young children as a set of general problem-solving skills—including pattern recognition, sequencing, algorithmic thinking, and debugging—that support learning across subjects (NAEYC; CSTA, 2025).

Strengthening Foundational Thinking helps districts strengthen literacy and math simultaneously, build coherence across PreK–2, introduce computational thinking developmentally, reduce fragmentation across initiatives, and support teachers without adding new silos. Rather than adding another program, this approach strengthens the cognitive infrastructure beneath existing goals.

What the Research Shows
- Executive function predicts growth in reading and math.
- Working memory supports comprehension and problem-solving.
- Pattern recognition predicts later mathematics achievement.
- Spatial reasoning predicts mathematics growth.
- Meaningful engagement improves retention and understanding.
- Playful, purposeful learning supports executive function and language development.
- Experimental studies show that coding and algorithmic play activities can strengthen executive function skills such as planning and inhibitory control in young learners (Arfé et al., 2019).

Strategic Takeaway
Districts do not need competing initiatives layered on top of literacy and math reforms. They need a stronger cognitive foundation that allows existing literacy and mathematics instruction to be more effective. By intentionally building Foundational Thinking across PreK–2, districts can improve literacy and math outcomes, support teachers with coherent instructional tools, prepare students for increasingly symbolic and computational environments, and strengthen long-term academic success.

Codie Blocks is one implementation model designed to operationalize Foundational Thinking principles in classrooms. Through hands-on sequencing, testing, and debugging activities, students exercise core cognitive capacities such as working memory, causal reasoning, and cognitive flexibility. By translating abstract ideas into physical actions and observable outcomes, Codie Blocks helps make thinking visible for both students and teachers.

RESEARCH BRIEFING

What Research Identifies as Foundational
Developmental science consistently shows that early-developing domain-general cognitive processes form the base for later academic learning. The National Academies identify symbolic representation, reasoning, and executive function as core foundations of early learning that support later literacy and mathematics. Activities that require children to plan sequences, test

outcomes, and revise errors naturally engage executive function systems—working memory, inhibition, and cognitive flexibility—the same systems later used in reading comprehension and multi-step mathematical reasoning (Arfé et al., 2019).

Shared Cognitive Base of Literacy and Math

Research shows that executive function — including working memory, inhibition, and cognitive flexibility — predicts growth in both reading and mathematics (Welsh et al., 2010; Blair & Razza, 2007). These findings indicate that literacy and math share underlying cognitive processes rather than operating as independent domains.

These cognitive capacities support key components of evidence-based reading instruction. For example:
- Working memory supports sentence comprehension and multi-step decoding.
- Sequencing supports narrative understanding and phoneme ordering.
- Symbolic reasoning supports letter–sound mapping.
- Cognitive flexibility supports reading comprehension and error correction.

Meaning and Engagement

Motivation and learning science demonstrate that when students perceive purpose or relevance in learning tasks, they engage more deeply and retain more. Purpose and meaning increase attention, persistence, and comprehension.

Play and Early Learning

The American Academy of Pediatrics and developmental science research demonstrate that play supports executive function, language development, and social reasoning. Structured playful learning environments improve academic outcomes while maintaining engagement.

Story and Context

Research on shared reading and narrative learning shows that story-embedded instruction improves vocabulary growth and comprehension. Meaningful contexts help children connect symbols to meaning, strengthening reading and reasoning skills.

Implications for Districts

Strengthening foundational thinking skills in PreK–2 can improve literacy and math outcomes, support computational thinking developmentally, align initiatives across early grades, and reduce instructional fragmentation.

EVIDENCE TABLE
FOUNDATIONAL SKILLS AND ACADEMIC OUTCOMES

Sequencing
Linked to statistical learning and early literacy development.

Pattern Recognition
 Preschool pattern knowledge predicts later mathematics achievement.

Symbolic Reasoning
 Symbolic representation supports literacy and math development.

Cause and Effect / Prediction
 Inferencing skills support reading comprehension growth.

Working Memory
 Strongly linked to reading comprehension and mathematics performance.

Spatial Reasoning
 Predicts later mathematics achievement.

Logic and Problem Solving
 Executive function predicts reading and math outcomes.

Debugging and Iteration
 Error monitoring and self-regulation relate to academic achievement.

Cognitive Flexibility
 Predicts literacy and math growth beyond IQ.

Attention and Self-Regulation
 Strong predictors of long-term academic achievement across reading and mathematics

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