Academic Success in Numeracy: Codie Blocks Builds Computational Thinking Skills and Empowers Young Minds

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In today's world, preparing children for success means helping them become strong thinkers and problem solvers. One of the most powerful and accessible tools to support this growth is early coding education. Coding builds computational thinking, a foundational skill that improves performance in numeracy and beyond.

This white paper explains how pre-coding in early childhood supports cognitive development, aligns with educational standards like the ***National Council of Teachers of Mathematics (NCTM) Mathematical Processes****, and improves academic achievement in numeracy. It also shows how* ***Codie Blocks*** *provides the perfect platform for children, educators, and parents to explore these skills together.*

Why Pre-coding Matters in the Early Years

Coding is more than just a technical skill. It's a way of thinking. For young learners, pre-coding is a playful, hands-on experience that builds:

- **Problem-solving:** Children test ideas and learn from mistakes.
- **Logical thinking:** They understand sequences, cause and effect, and conditions.
- **Pattern recognition:** Kids identify and repeat patterns, a core math skill.

These skills, known collectively as computational thinking, help children in mathematics and logical reasoning. According to Dr. Marina Bers (2018), coding provides an opportunity for children to think systematically and grow more resilient through trial-and-error learning.

Codie Blocks introduces these ideas through an engaging interface where children build sequences by using symbolic blocks—great for pre-readers. It’s designed for early learners, making it an ideal introduction to computational thinking and numeracy.

Numeracy Gains through Coding

Coding builds essential math skills like:

- Counting and number sense
- Patterns and sequences
- Spatial reasoning and geometry

Clements and Sarama (2020) found that coding improves children’s ability to think numerically and spatially. These gains translate directly to early math achievement. In ***Codie Blocks***, children apply math concepts naturally as they plan movements, repeat actions with loops, or debug sequences by recognizing patterns—helping them “see” math in action.

Long-Term Impact on Numeracy

Although early coding is still a relatively new area of study, recent research suggests that its academic benefits persist into later years. A 2020 study by Relkin, Maloney, and Uccelli found that early computational thinking improves executive function skills, which are strong predictors of long-term academic success in mathematics. Clements and Sarama (2020) demonstrated that early gains in number sense, geometry, and spatial reasoning, when nurtured through coding and play-based math, continue into later grades.

PISA (Programme for International Student Assessment) assesses 15-year-olds in mathematics, reading and science every three years. It focuses on real-world problem solving, reasoning, and critical thinking as well as curriculum content. Although PISA does not directly measure early exposure to coding or sequencing, research indicates that computational thinking—central to coding—is positively associated with key numeracy skills such as logical reasoning, pattern recognition, and structured problem-solving. These foundational abilities align closely with the types of mathematical thinking assessed by PISA, suggesting that early coding education may indirectly support higher performance in international numeracy benchmarks.

For example:

- The **Organisation for Economic Co-operation and Development (OECD)'s** "Future of Education and Skills 2030" framework highlights computational thinking as a key 21st-century skill and links it to success in problem-solving and mathematics.
- Research by the **Education Endowment Foundation (UK)** and **European Schoolnet** shows early coding programs improve skills like pattern recognition, logic, and problem decomposition, all core numeracy skills.
- A **2018 Nuffield Foundation study** found early computing education supports early mathematical reasoning, especially among young learners.

Pre-coding and the NCTM Mathematical Processes

The **NCTM Mathematical Processes** outline how students learn and apply math effectively. These processes align beautifully with what pre-coding teaches:

NCTM Process	How *Codie Blocks* Supports It
Problem Solving	Children design and test solutions by developing sequences.
Reasoning and Proof	Debugging encourages logic, predictions, and justifying outcomes.
Communication	Students explain their symbolic sequence and collaborate with peers.
Connections	Children see how pre-coding links to math and real-life problems.
Representation	Code becomes a visual, concrete way to represent abstract thinking.

Using a tool like ***Codie Blocks*** ensures that students are not only meeting educational standards but doing so in a developmentally appropriate and highly engaging way.

A Tool for Classrooms and Homes

Codie Blocks was designed with educators, parents, and children in mind:

- **For educators: *Codie Blocks*** supports curriculum integration, scaffolds learning, and offers a cross-curricular way to teach math and STEM.
- **For parents:** It's easy to use at home, even without a tech background. Children can work independently or with support of parents to foster computational thinking skills.
- **For children:** It's developmentally appropriate, hands-on, and so much fun!

Conclusion

Early coding with ***Codie Blocks*** builds a foundation of thinking that extends far beyond the screen. It nurtures computational thinking, supports numeracy, and aligns with trusted educational frameworks like the NCTM Mathematical Processes.

Research now points to **lasting academic benefits**, particularly in the development of executive function and early math skills that persist over time. By bringing pre-coding into the lives of young children at school and at home, we're giving them the tools to become confident, capable learners ready for the future.

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