
# Developing Mathematical Thinking:
# Bridging Core and Intervention Curricula

RESEARCH OVERVIEW

BY

**Jonathan Brendefur, PhD**

**and Associates**

DEVELOPING MATHEMATICAL THINKING INSTITUTE

JONATHAN BRENDEFUR, PHD
AND COLLEAGUES

# THE PERSISTENT PUZZLE OF MATH EDUCATION: BRIDGING CORE AND INTERVENTION CURRICULA

(RESEARCH OVERVIEW)

## Introduction

For over four decades, U.S. math education has wrestled with a stubborn paradox: despite the widespread adoption of standards-aligned core curricula and targeted interventions, national math achievement has remained stagnant since the 1980s (Akkus, 2016; CCSSO, 2022). This stagnation is not the result of apathy or lack of innovation, but rather systemic missteps in how core, supplemental, and intervention resources are designed, implemented, and aligned. Understanding the nuanced roles and components of each is essential for school leaders, teachers, and parents seeking to move the needle for all students.

## Core Math Curriculum: The Foundation of Consistent, Equitable Instruction

A high-quality core math curriculum is a comprehensive, grade-level program designed to meet state or national standards and ensure all students receive consistent, foundational math instruction (Akkus, 2016; Achieve the Core, n.d.; CCSSO, 2022). Its main components are carefully structured to provide both depth and progression:

- **Content Standards:** Clearly defined learning goals for each grade, such as those in state standards, covering domains like number operations, algebra, geometry, measurement, and data.
- **Instructional Sequences:** Lessons and units that build knowledge progressively, ensuring coherence across grades and topics.
- **Practice Standards:** Emphasis on mathematical models, reasoning, problem-solving, and communication, not just rote procedures.
- **Assessment Tools:** Formative and summative assessments to monitor student progress and guide instruction.
- **Differentiation:** Strategies and materials to address diverse learning needs within the classroom.
- **Spiral Review:** Regular revisiting of previously learned concepts to reinforce retention.
- **Application Tasks:** Real-world problems and inquiry-based activities to deepen understanding.

Core curricula can foster conceptual understanding and procedural fluency when implemented and supported by ongoing professional development and community engagement (Akkus, 2016; CCSSO, 2022). For example, Alabama's Numeracy Act paired rigorous core instruction with teacher professional development, resulting in significant gains on the NAEP assessment (CCSSO, 2022).

However, while most teachers are well-versed in procedural math, knowing the steps and algorithms to solve problems, they often ***lack the deep conceptual understanding*** necessary to explain why those procedures work or to help students make meaningful mathematical connections (The Science of Math, 2021). This imbalance is a legacy of traditional math education, where textbooks and instruction have prioritized rote procedures over conceptual reasoning, resulting in classrooms where students can follow steps but struggle to apply their knowledge flexibly or solve novel problems (Learn Implement Share, n.d.). To address this gap, targeted ***professional development is essential***. Programs like the Developing Mathematical Thinking Institute (DMTI) provide ongoing, math-specific professional development that helps teachers deepen their conceptual understanding, refine instructional strategies, and foster mathematical thinking in students through collaborative unit studies, demonstration lessons, co-teaching, and reflective practice (DMTI, 2025).

## Supplemental Math Materials: Targeted Support and Enrichment

While the core curriculum provides the backbone of daily instruction, supplemental math materials serve as flexible resources to support, enrich, or remediate learning. These materials are not designed to replace the core program, but rather to address specific needs that arise in the course of instruction:

- **Targeted Practice:** Focused on particular concepts and skills where students need extra help or challenge.
- **Flexible Formats:** Instead of a full course structure, short units, worksheets, games, videos, or online tools may be used.
- **Just-in-Time Support:** Used to provide immediate help when students struggle with specific topics, often in small groups or one-on-one settings.
- **Customization:** Tailored to individual or small group needs, rather than following a set sequence for an entire class.

The key distinction is that while the core curriculum is comprehensive and sequential, supplemental materials are targeted and flexible, providing just-in-time support or enrichment as needed (Achieve the Core, n.d.).

## Intervention Curriculum: Intensive, Individualized Instruction

Intervention curricula are designed for students at risk or performing below grade level, providing additional, often individualized, instruction (Frontiers in Education, 2023). Effective interventions combine enactive (physical), iconic (visual), and symbolic (abstract) math models with problem-solving and computation fluency, all grounded in evidence-based practices. Screening and progress monitoring are important to identify needs and adjust instruction. Interventions are most impactful when integrated with core instruction and supported by ongoing professional development (Frontiers in Education, 2023).

However, interventions fail when used to supplant (replace) core instruction. A 2013 federal study found that schools

substituting intervention programs for core curricula saw short-term gains but long-term stagnation, as students missed critical grade-level content (IES, 2013).

## Core vs. Supplemental: Key Differences

| Feature | Core Math Curriculum | Supplemental Math Materials |
|---|---|---|
| Scope | Full-year, comprehensive | Targeted, specific topics |
| Purpose | Main source of instruction | Support, enrichment, remediation |
| Structure | Sequential, standards-based | Flexible, as-needed |
| Assessment | Built-in, aligned with standards | May include informal or formal checks |
| Differentiation | Included, but for whole class | Highly individualized |

A core math curriculum provides a structured, standards-based foundation for all students, while supplemental materials address gaps, extend learning, or provide additional practice as needed. Intervention curricula offer intensive support for students who need more than what core and supplemental resources can provide.

## Why Progress Has Stalled: Systemic Barriers and Misconceptions

Despite decades of reform, progress has been limited by several systemic barriers:

- **Underfunded Professional Development:** Despite being responsible for foundational learning, fewer than 30% of elementary teachers feel prepared to teach standards-aligned math content, largely due to insufficient professional development that leaves many lacking not only deep conceptual understanding but also confidence in using visual models and precise mathematical language, key elements for helping students build lasting understanding and communicate mathematically (Akkus, 2016; NCTQ, 2025; IES, 2024).
- **Neglected Formative Assessment:** Teachers often lack time or training to implement formative practices like exit tickets or peer feedback, which are shown to boost achievement by 20% (ERIC, 2021; Barton, 2018).
- **Misaligned Prior Knowledge:** Core curricula assume grade-level readiness, yet many students lack foundational skills. Without formative data to identify gaps, teachers cannot adjust pacing or provide targeted support (Brookings Institution, 2024).
- **The Supplant-Substitute-Supplement Trap:** Schools sometimes misuse educational funds and resources, supplanting by using federal funds to replace state or local resources (e.g., funding a mandated special education teacher with Title I dollars), substituting by pulling struggling students from core classes for basic skills (thus denying access to grade-level content), or, at least more appropriately, supplementing by adding resources like after-school tutoring to enhance core programs. Unfortunately, decades of policy have often

incentivized supplanting and substituting, with a 2020 audit revealing that 40% of Title I schools used funds to backfill budget gaps, violating federal guidelines (U.S. Ed., 2020).

Dispelling common misconceptions is also essential for effective math instruction and school improvement. It is ***incorrect to believe that interventions can replace core instruction***; supplanting core curriculum with intervention programs denies students access to grade-level content and can widen achievement gaps. ***Another misconception is that all interventions are equally effective***, when research shows that teacher-led small groups outperform technology-only tools by 15%. Additionally, interventions are not solely for remediation; targeted interventions can accelerate learning for advanced students (Frontiers in Education, 2023).

## A Path Forward: Research-Based Recommendations

Moving forward, schools should prioritize investing in teacher expertise through ongoing, content-focused ***professional development***, empowering educators to implement core curricula effectively and confidently (CCSSO, 2022). Intervention materials should be used as supplements rather than replacements for core instruction, with intervention curricula integrated alongside the primary curriculum to provide ***targeted support*** without sacrificing access to grade-level learning. Additional critical steps include aligning ***vocabulary and instructional practices*** across all settings, setting clear goals for intervention time, and encouraging collaborative planning among teachers, coaches, and leaders.

To advance student achievement, educators should ensure that intervention and supplemental supports are strategically integrated with core instruction so that every student can access high-quality, grade-level mathematics. Schools can create the conditions necessary for meaningful and sustained improvement in math outcomes by focusing on teacher growth and purposeful curriculum alignment.

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DMTI
Math Success


For more information

contact@dmtinstitute.com

www.mathsuccess.io

Developing Mathematical Thinking Institute, Inc.
500 South 8th Street
Boise, Idaho 83702

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