Brain Scie...

Rigor Means H...

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Gamification

Math Pro...

Beyond the Buzzwords:
Separating Myths from Reality in Math Education

**A field guide for district leaders,
built on neuroscience strategies that work**

MIND
E D U C A T I O N ®

Contents

The story of declining math achievement is not just a COVID hangover. Scores were sliding well before the pandemic, and while some recovery is underway, the long-term trends show persistent gaps and systemic weakness.

Many leaders have made changes. But here's the hard truth: **not all change is the right kind of change.** Too often, districts are sold surface-level innovation that promises transformation but fails to deliver deep, lasting math understanding.

And that's why this matters. District administrators know we need bold, effective strategies to turn this tide. But with vendors pushing a wave of "revolutionary" math products, how do we separate genuine solutions from buzzwords and spin?

This eBook tackles that problem head on. By debunking common myths in math education and exposing how buzzwords get misused, it equips decision-makers to focus on what really matters: programs built on how the brain learns math, with evidence to prove it.

not all change is the right kind of change

"Personalized Learning Tech Will Fix All Gaps"

Personalized technology can close achievement gaps by routing students into remedial lessons that target missing skills.

The Reality:

Research says otherwise. A large-scale study of an online math program found that students routed into remedial content did **not** perform better on overall math assessments than peers who stayed with grade-level instruction (Pane et al., RAND Corporation, 2017). Students may have moved more quickly through remedial units, but most never caught up — and many never returned to grade-level content.

Part of the problem lies in the algorithms themselves. In a well-meaning attempt to avoid student frustration, many adaptive systems move kids backwards into easier content. But this holds students back instead of propelling them forward, robbing them of the chance to turn struggle into curiosity and persistence. The result is a generation of learners who never fully catch up to grade-level expectations.

The brain doesn't learn math by memorizing disconnected skills. It constructs **schemas**, or networks of understanding. Remediation that strengthens isolated skills without rebuilding those deeper structures can't produce durable learning. **Memorization is valuable only when connected to meaning.**

The highest-impact personalization keeps students on the grade-level journey while adjusting pacing and scaffolds to make learning accessible. Think of it like a marathon: some runners need to slow their pace or take more water breaks, but they're all still running the same race. Sending struggling runners off to play basketball won't make them better distance runners. Likewise, sending students into endless remedial tracks isn't true personalization — it's diversion. And for multilingual learners and students already at risk of being left behind, diversion compounds inequity.

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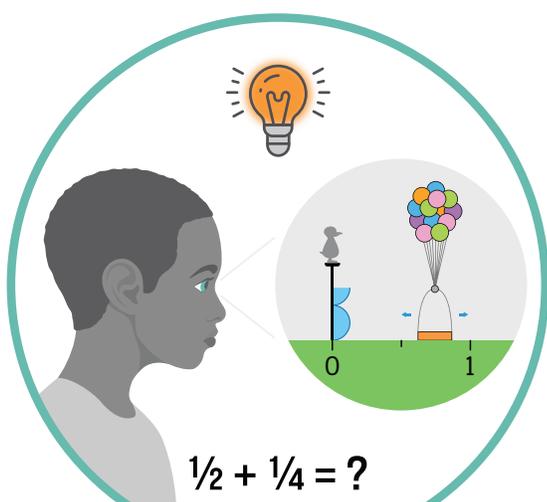
Visual-first instruction removes language barriers and provides equal access for all learners

LEADER CHECKPOINT
Questions to Ask Vendors:

- Does your program personalize by adjusting pacing and scaffolds while keeping students on grade-level content?
- How do you ensure students aren't tracked into endless remedial loops?
- Can you share independent research showing gains on grade-level assessments, not just internal program measures?

"One Math Program Is As Good As Another"

Math programs are often treated as interchangeable, with the assumption that replacing one will yield the same outcomes.

The Reality:

Research shows otherwise. In a multi-state study by MIND Research Institute, schools that stopped using one particular math program after years of success — often replacing it with a competing product — saw declines in performance. The study tracked grades 3–5 across multiple states, comparing those that continued versus those that discontinued. The results were clear: schools that kept using the program (ST Math) rose from the 50th to the 53rd percentile in statewide rankings, while those that abandoned it fell to the 44th.

The lesson is straightforward: removing a proven program doesn't just stall progress, it can undo years of gains. But this isn't only about one program. When we treat curriculum like a commodity, we give providers a free pass to recycle inert content without consequence. It's the sugar pill problem: no matter how skilled the diagnosis, if the medicine is ineffective, patients don't improve. Several states, including California and Georgia, are beginning to change this narrative by holding curriculum accountable for demonstrated results during adoption.

The message for leaders: curriculum swaps aren't risk-free. **Changing to programs without strong, replicated evidence can undo gains and set students back**, especially for multilingual learners and those who need consistent access to grade-level concepts. The key is sticking with solutions that have demonstrated impact and provide consistent access to grade-level content.

When schools removed a proven visual math program (ST Math) and reverted to "business as usual," student math achievement dropped sharply.

> In a multi-state study, grades that **stopped** using ST Math fell from roughly the **50th to the 44th percentile** in state ranking, while similar grades that **continued** using ST Math rose to the **53rd percentile.**

The loss of ST Math's benefit outweighed any gains from the replacement program.

LEADER CHECKPOINT
Questions to Ask Vendors:

- What unique learning design elements set this program apart from others?
- Does the content provide inherent, formative feedback while keeping students on grade-level?
- Do you have longitudinal studies proving sustained gains over multiple years and contexts?
- If we replace our current program, what evidence shows that students won't lose ground?

"Our Program Is 'Research-Proven' (Trust Us!)"

Programs labeled 'research-proven' are often assumed to have strong, reliable evidence behind them.

The Reality:

All evidence is not equal. A federally funded, large-scale randomized controlled trial in Texas tested a widely used math program with nearly 10,000 students over two years (IES, 2017). The results showed no statistically significant impact on state test scores. In fact, the effect was equivalent to moving a student from the 50th to only the 53rd percentile — a tiny bump that could easily occur by chance. The researchers themselves concluded: "the study did not yield confirmatory evidence that [the program] improves student learning."
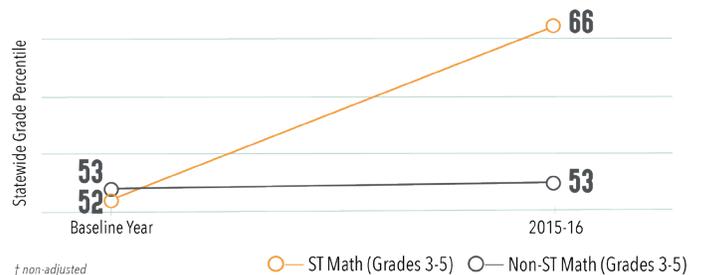
Here's the irony: the study is published, appears on the What Works Clearinghouse, and is still cited by the vendor as "proof" of effectiveness. On the surface it looks impressive — large sample, rigorous design, federal funding. But the results show no meaningful impact.

LEADER CHECKPOINT
Questions to Ask Vendors:

- What level of ESSA evidence does your program meet? And has that rating been independently validated?
- What type of research supports your program — internal staff or independent researchers?
- How large and diverse were the student populations?
- What effect sizes and state-level outcomes can you share, and do those results replicate at scale across multiple states and diverse learners?

This example isn't unique. **Many ed-tech "studies" are vendor-run or rely on small pilots without control groups.** That's why leaders must look beyond the label "research-proven" and ask for details: Who conducted it? Was it independent? Was it peer-reviewed?

On the flip side, some programs do meet the highest bar. ST Math, for example, has multiple independent studies behind it. A cross-state evaluation by WestEd examined over 42,000 students in grades 3–5 across 239 schools in 14 states. The findings were clear: schools that consistently implemented ST Math improved their statewide math rankings by an average of 14 percentile points, with effect sizes up to 0.43 in grade-level proficiency. The study was later reviewed by SRI International, which confirmed it meets ESSA Tier 2 standards.

11 STATE ASSESSMENTS
239 SCHOOLS
14 STATES

Growth in Statewide Ranking of Math Scores †

Statewide Grade Percentile

66

53
52

53

Baseline Year — 2015-16

† *non-adjusted*   ○— ST Math (Grades 3-5)   ○— Non-ST Math (Grades 3-5)

In addition, a federally funded randomized controlled trial involving more than 16,000 students found significant positive effects on math achievement ($p < 0.001$), especially in grades 4 and 5.

That's what true evidence looks like.

"Gamification = Student Engagement"

Gamification strategies like points, badges, and prizes are often assumed to increase student engagement in math.

The Reality:

Extrinsic rewards can boost short-term compliance, but they don't create lasting engagement or deeper understanding. Decades of research (Deci, Koestner, & Ryan, 1999) show that when students are motivated by external rewards, intrinsic motivation often decreases. Students may click more, but they don't think more.

When engagement is built on chasing rewards, motivation fades as soon as the prize disappears. In contrast, authentic game-based learning taps into curiosity and problem-solving. **Done right, the game is the learning.** Kids will persevere through hard problems not for points, but for the satisfaction of figuring things out.

Think of how many times a child will attempt a tough level in a video game. That same persistence can happen with well-designed math puzzles. Students engaged in this kind of learning demonstrate resilience, grit, and a growth mindset. For multilingual learners and those with math anxiety, the difference is especially powerful — because the process itself becomes the reward.

For district leaders, the question is simple: are students truly thinking mathematically and enjoying the process, or just playing an arcade game that occasionally pauses for math questions?

LEADER CHECKPOINT
Questions to Ask Vendors:

- How does your program build intrinsic motivation for students, not just compliance through rewards?
- Can you show how students engage with authentic problem solving rather than chasing points?
- What evidence do you have that students develop perseverance, discussion, and creative strategies in your program?

Rigor in math is often defined as giving students harder problems, more practice, and faster recall of facts—speed and difficulty equal rigor.

The Reality:

True rigor isn't about racing or piling on difficulty. It's about depth of understanding and the ability to apply math in new contexts. **Memorization is valuable — only when connected to meaning.** Students need fluency and recall, yes, but those must be built on conceptual understanding.

Crucially, rigor is not an inherent quality of the problem itself — it's in the action students take. A "rigorous problem" is not simply one that looks complex; it's whether students approach it with reasoning, persistence, and sense-making.

Research supports this. When students engage in **creative reasoning** before being shown formulas, they score about 10% higher on follow-up tests than those taught step-by-step

procedures (Jonsson et al., 2014). Brain scans revealed the reasoning group also used less mental energy, showing that sense-making built stronger neural pathways. Likewise, studies on **productive struggle** confirm that grappling with ideas, rather than being spoon-fed procedures, leads to deeper, more durable learning.

This challenges the notion that speed = rigor. Programs that equate rigor with fast recall risk alienating multilingual learners and students who need more processing time.
And in today's world, calculators, Photomath, and ChatGPT can execute procedures in milliseconds. What technology can't do is **reason, apply concepts in new contexts, and justify solutions. True rigor is about depth of understanding and higher-order thinking.** That's the rigor our students need.

Often, it looks slower on the surface — fewer problems solved, but with greater depth. Yet the payoff is mastery that sticks. Leaders should be skeptical of any solution that defines rigor by volume or speed alone. Instead, look for curricula that balance procedural fluency with conceptual exploration and application, preparing students to be problem solvers in an unpredictable future.

LEADER CHECKPOINT
Questions to Ask Vendors:

- How do you balance memorization and fluency with conceptual understanding?
- What opportunities do students have to reason, explain, and solve problems in new contexts?
- What research demonstrates that your approach develops deeper, more durable learning rather than short-term recall?

# "Learning Science Is the Same as Brain Science"

Programs that reference 'learning science' or 'brain-based' approaches are often assumed to be grounded in neuroscience.

The Reality:

Learning science is valuable, but it's not neuroscience. Learning science draws from psychology, education research, and instructional design. Neuroscience examines how the brain actually learns — through visual-spatial reasoning, perception-action cycles, and feedback loops.

Too many publishers blur the distinction, using language to make their programs sound cutting-edge. **It may sound scientific, but often it's marketing dressed up as science.**

The Difference: At MIND, we've lived this work for nearly 30 years, translating neuroscience into **patented, visual-first designs** that make math accessible for every learner. Our programs are the only PreK–8 solutions truly built on how the brain learns. That's why our programs show replicated, independent results at scale. Many providers borrow the language, but few can show evidence of real impact. Actions matter more than rhetoric.
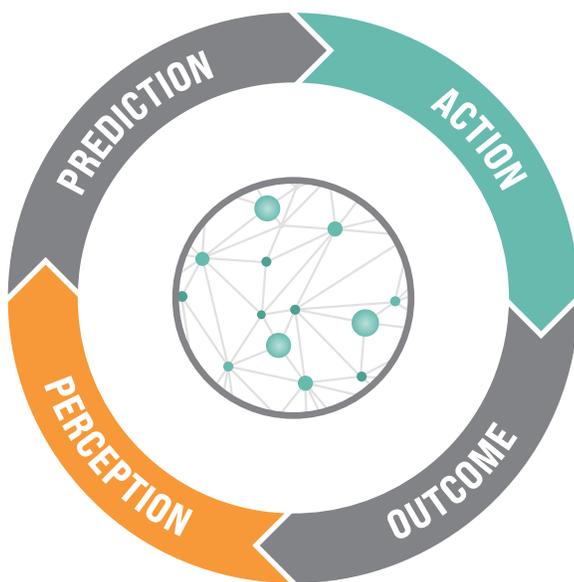
Perception-Action Cycle

LEADER CHECKPOINT
Questions to Ask Vendors:

- What's the difference between how your program uses *learning science* and how it leverages actual *neuroscience*?
- Which neuroscience principles (e.g., visual-spatial reasoning, perception-action cycles, feedback loops) are embedded in your design?
- Can you show published research demonstrating brain-based impact, not just general learning studies?
- How does your program ensure accessibility for diverse learners by leveraging the brain's natural pathways?

The Way Forward: Building Thinkers

Throughout this e-book, we've pulled back the curtain on too frequently used claims in math education. Our math crisis will be solved by approaches that embrace how children truly learn math – through exploration, visual reasoning, meaningful feedback, and practice that leads to insight, not just rote memory. It will be solved by holding programs accountable to the highest research standards and refusing to settle for mediocre results.

As educators and leaders, we need to demand more from our math solutions.
Here's a recap of what to look for, grounded in the evidence:

Evidence of Effectiveness: Insist on programs with independent, rigorous research backing their efficacy. One good study isn't enough – look for a track record of results across varied contexts. If a product's claims sound too good to be true or rest on flimsy evidence, trust your skepticism. Students deserve approaches proven to deliver significant and lasting gains.

Conceptual Depth and Problem Solving: Prioritize curricula and software that develop deep understanding. Ask providers how they foster creative problem solving and critical thinking. The best programs will be able to articulate how they build conceptual foundations (for example, through visual models, puzzles, or inquiry-based lessons) and how they teach students to transfer skills to new problems.

Intrinsic Engagement: Look for learning experiences that spark students' natural curiosity. Engagement should come from interesting math challenges and interactive learning - not just from external rewards or "edutainment" fluff. When you see students excited to tackle a tough problem, persevering after setbacks, and celebrating an "aha!" moment, you know the program has hooked their intrinsic motivation.

Support for All Learners without Lowering the Bar: The right solution will have scaffolds to support struggling learners and pathways to extend high achievers, all while keeping everyone aiming for rich mathematical tasks. Avoid those that pigeonhole or "track" students into watered-down content. Every student can rise to high expectations with the proper support, and your chosen programs should embody that belief.

Conclusion: Beyond the Buzzwords

As educators and leaders, we can't afford to chase fads or half-measures while today's math crisis threatens opportunities for an entire generation. The good news is that when classrooms are grounded in research and designed around how the brain learns, students don't just copy algorithms — they explore, discuss, and truly make sense of math. That curiosity builds confidence, resilience, and the kind of problem-solving our future demands.

Many providers now echo the language of neuroscience, but without **replicated, independent evidence of impact at scale,** it's just rhetoric. MIND Education is different. As a nonprofit with **patented, neuroscience-driven design,** we've shown for nearly 30 years that when students see math the way the brain learns, they achieve more — and they think more deeply. That's why we built both ST Math and InsightMath — different solutions, same foundation. From supplemental to comprehensive, our programs show what happens when math is taught the way the brain learns.

No buzzwords.
Just math done right, with **research, rigor, and heart.**

Experience Solutions Grounded in Math the Way the Brain Learns

InsightMath

MIND EDUCATION®

ST Math

Join the Conversation

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