NAVIGATING THE MATH WARS: A PRACTICAL GUIDE TO THE DIVIDES AND DEBATES INFLUENCING MATH INSTRUCTION

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"The Math Wars: Timed Tests, Math Anxiety, and the Battle Over How We Teach Our Kids"

The Saturday Evening Post, May 28, 2024

"How A Debate Over The Science Of Math Could Reignite the Math Wars"

The Hechinger Report, May 8, 2023

"Are 'Math Wars' Really the Same As 'Reading Wars?'"

Forbes, March 15, 2023

"How Math Became an Object of the Culture Wars"

The New Yorker, November 14, 2022

"How We Can Finally End the 'Math Wars'"

Education Week, August 22, 2022

"The Faulty Logic of the 'Math Wars'"

The New York Times, June 16, 2013

These headlines, and similar ones going back to the 1990s when the term "Math Wars" first entered the national lexicon, reflect decades of fierce, unresolved debate over how mathematics should be taught and learned. What started as a contentious public debate between advocates for reform-oriented and traditional approaches to math education has continued to capture the media's attention to this day. Over time, the term has come to include a broad range of debates about what mathematics students should learn, how it should be taught, and, more recently, whose expertise and research should guide those decisions.

The conflict has its roots in the early twentieth century, but its modern, public form was shaped in the decades that followed. In 2010, the Common Core State Standards sought to broker peace by establishing a shared K-12 framework designed to address longstanding divides, such as the tension between practicing procedural fluency and building deeper conceptual understanding. Instead, it reignited old tensions. Although political backlash has since pushed the Common Core out of the spotlight, at least in name, new fronts have opened. Particular math curricula have drawn intense scrutiny, and a movement calling itself the Science of Math has emerged, arguing that instructional decisions should be grounded in cognitive science and empirical research, a goal shared by many on both the traditional and reform sides of the Math Wars.

Given the stakes, it is not surprising that the Science of Math has stirred such intense debate. Math achievement in the United States has declined since its 2013 peak,[1] a slide the pandemic only accelerated, and many district leaders are looking for ways to improve it. Policymakers, meanwhile, are watching closely after witnessing what happened in reading instruction, where a movement called the Science of Reading successfully challenged decades of practice built around Lucy Calkins' "balanced literacy" approach through legislative mandates, parent lawsuits, and a return to phonics-based instruction. Many are asking whether math is headed for a similar reckoning. But the parallel has limits. Unlike the Science of Reading, which eventually achieved something close to a professional consensus, the Science of Math has faced strong criticism from the field's most prominent math organizations, who argue that the movement misapplies research and promotes too narrow a vision of what math teaching could be. Whether the Science of Math represents a lasting reorientation or just another front in an unresolved war, the movement's stances and surrounding controversy are worth understanding on their own terms.

The debates grouped under the Math Wars cover a wide range of issues: discovery learning versus direct instruction, whether to accelerate students with advanced content, how tracking affects equity, and the link between timed practice and math anxiety, to name a few. Too often, these disputes leave school leaders, teachers, and parents navigating a confusing mix of terms and competing recommendations.[2] Some of these fault lines, when examined more closely, are less clean binaries than they first appear. But that does not make them trivial. They still involve consequential disagreements about instructional sequence, default emphasis, and the kinds of evidence that should carry the most weight in policy and practice.

This guide is designed to help readers navigate that terrain. It traces the

1. NAEP provides the most reliable available measure of long-term, national trends in mathematics achievement and remains the standard reference for tracking performance over time. However, several cautions apply when interpreting score changes. Because NAEP uses matrix sampling and does not produce individual student scores, it is not designed to evaluate the effectiveness of specific instructional approaches at the classroom or district level. Additionally, score changes can partly reflect measurement artifacts rather than shifts in actual student learning (e.g., when national assessment frameworks are not yet aligned to recently revised state curricula). The post-2013 decline referenced here should therefore be understood as a broad population-level signal warranting attention, not as a precise diagnostic of instructional failure.

2. See Appendix A for glossary of key terms.

origins of these divides, their evolution, and what they look like today. For each major divide, presented as a dichotomy, we identify the traditional and reform ends of the spectrum, summarize each side's main arguments and evidence, and note where the Science of Math movement falls along that continuum. The Science of Math receives particular attention because it has become a significant flashpoint in recent years, shaping state policy, curriculum conversations, professional learning, and public debate. That focus should not be mistaken for an endorsement. Rather than adjudicating the full bodies of research underlying each dichotomy, the guide aims to give state and district leaders a clearer map of the terrain so they can evaluate the competing claims already reaching their schools, determine which matter most for their context, and make more informed decisions. Where the guide assesses specific claims, particularly those about the Science of Math movement, it does so based on the movement's own published positions.

To that end, we also examine how the Math Wars are playing out in practice, exploring policies enacted since the pandemic and reviewing what we know about math teachers' commonly used practices. The guide concludes with suggested next steps at both the local and national levels, with appendices providing a glossary of key terms and additional detail for readers who want to go deeper.

THE "OLD" MATH WARS: TWO ROADS DIVERGED

To understand why math education has been so fiercely debated, it helps to look back to the early twentieth century, when John Dewey, one of America's most influential education reformers, described two opposing "sects" in education with starkly different views on how children learn best. While Dewey rejected the extremes of both sides, he recognized a key question that led to **two diverging roads**: should education begin with the accumulated knowledge and experience of the teacher, organized into a formal curriculum, or with the needs, interests, and abilities of the student as the foundation for learning?[3]

Dewey hereby identified one of education reform's earliest fault lines: whether curriculum-centric or student-centric approaches to teaching and learning should take precedence. This **pedagogical divide**, he warned, should not be treated as a war between antagonists, yet that is precisely what happened over the decades, as his nuanced vision hardened into polarized positions on education in general and mathematics in particular. Dewey's own view was more integrative. The student and the subject matter, he argued, serve as two necessary anchors for the teacher, who uses the organized curriculum as a guide to understand students' current capacities and shape the environment to direct their ongoing growth.[4] This divide can still surface today whenever districts debate whether to adopt a curriculum that leads with teacher modeling or with student exploration. The table below draws on Dewey's original essay to show how the subsequent emergence of "traditionalist" and "reformer" stances pulled these two anchors apart, producing the opposing positions on math education that continue to define the Math Wars today.

3. Dewey, "The Child and the Curriculum," 7-10.

4. Ibid., 11, 30-31.

Table 1. Two Sides, Two Approaches: A Pedagogical Divide that Shaped Education

<table>
<tr><td colspan="4">In 1902, John Dewey identified a key divide between two groups in education that, over time, articulated increasingly polarized approaches to teaching and learning.</td></tr>
<tr><td colspan="2">"One [group] fixes its attention upon the importance of the subject-matter of the curriculum... Let the [student] proceed step by step to master each one of these separate parts... The [student] is simply the immature being who is to be matured."[5]</td><td colspan="2">"Not so, says the other [group]. The [student] is the starting-point, the center, and the end... Learning is active... It is [the student] and not the subject-matter which determines both quality and quantity of learning."[6]</td></tr>
<tr><td colspan="2">"Traditionalists"</td><td colspan="2">"Reformers"</td></tr>
<tr><td>Historical Polarization</td><td>Math Wars Polarization</td><td>Historical Polarization</td><td>Math Wars Polarization</td></tr>
<tr><td>• Teacher-led instruction</td><td>• Procedural fluency over conceptual understanding</td><td>• Student-centered pedagogy</td><td>• Conceptual understanding over procedural drills</td></tr>
<tr><td>• Mastery of established subject matter</td><td>• Explicit instruction over discovery learning</td><td>• Curriculum built from the learner's interests and experiences</td><td>• Inquiry-based learning over direct instruction</td></tr>
<tr><td>• View of the student as needing to acquire organized knowledge from the outside in</td><td>• Acceleration and early introduction of algebra</td><td>• Emphasis on active, hands-on, exploratory learning</td><td>• Integration of math into real-world contexts</td></tr>
<tr><td>• Emphasis on systematic instruction and sequential coverage</td><td>• Standardized testing as accountability</td><td>• Teacher as facilitator rather than direct instructor</td><td>• Flexible pacing and de-emphasis on timed testing</td></tr>
</table>

With this divide in mind, it becomes easier to recognize how these early 20th-century roots still shape today's Math Wars. **Traditionalists** value a sequenced teacher-led progression of skills and procedures that all students must master, while **reformers** emphasize student-centered problem-solving, exploration, and the application of mathematics to real-world problems. Over the decades, successive waves of reform and backlash have hardened these positions into entrenched camps. The result is a century-long chain of events, with each shift in influence paving the way for the next, culminating in today's debates over the Science of Math and beyond. Next, we trace key moments across the decades to illustrate how that chain unfolded.

5. Ibid., 7-8.

6. Ibid., 9.

1950s-1970s: New Math and Cold War Competition

The 1957 launch of Sputnik by the Soviet Union jolted U.S. policymakers and educators into action, fueling fears of falling behind in science and technology. In response, the federally funded "**New Math**" movement, led by university mathematicians and curriculum developers, sought to elevate mathematical rigor by introducing concepts like set theory, number bases, and symbolic logic into K-12 classrooms.[7] While intended to build deep conceptual understanding, the approach was often overly abstract and poorly aligned with teacher preparation.[8] Many parents and educators also saw it as disconnected from the practical skills students needed. By the early 1970s, widespread frustration led to a "**Back to Basics**" backlash, restoring emphasis on computation and foundational skills.[9]

1980s-1990s: The Rise of Reform Math and the First Math Wars

In 1983, the federal report *A Nation at Risk* warned of a "rising tide of mediocrity" in American education, sparking nationwide concern about academic standards and economic competitiveness. The report created a policy climate ripe for reform. In 1989, the National Council of Teachers of Mathematics (**NCTM**) released its ***Curriculum and Evaluation Standards***, a landmark agenda that emphasized problem solving, mathematical reasoning, and real-world application while de-emphasizing rote memorization and repetitive computation.[10] These standards shaped textbooks, curricula, and state assessments throughout the 1990s, leading to the widespread adoption of programs such as Everyday Mathematics, TERC Investigations, and MathLand.[11] However, some critics argued that these materials sacrificed precision, minimized basic skills, and left students underprepared for advanced math. Advocacy groups like **Mathematically Correct** and **NYC HOLD** emerged to oppose NCTM-style reforms, marking the period when the term "Math Wars" first took hold in public discourse.[12]

2000s: Searching for Common Ground Through Evidence

In an attempt to resolve these disputes, the federal government convened the **National Mathematics Advisory Panel** (NMAP) in 2006. Comprised of 24 expert members, the panel reviewed over 16,000 research publications and policy reports to issue recommendations based on the best available scientific evidence for improving mathematics instruction and student performance. Its

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7. Loveless, "A Tale of Two Math Reforms," 184-209.

8. Askey, "Good Intentions Are Not Enough," 163-183.

9. Burrill, "Mathematics Education," 25-41.

10. Ibid., 28.

11. Askey, "Good Intentions Are Not Enough," 170.

12. Loveless, "A Tale of Two Math Reforms," 184, 198.

2008 report called for a streamlined, coherent PreK-8 mathematics curriculum that emphasizes a well-defined set of critical topics, including proficiency with whole numbers and fractions, to prepare students for early, authentic algebra instruction.[13] Addressing core Math Wars debates, the NMAP deemed the conflict between conceptual understanding and procedural fluency "misguided," concluding that the two are mutually supportive.[14] The panel also explicitly stated that high-quality research does not support exclusive reliance on either "teacher-directed" or "student-centered" instruction.[15] In the years that followed, stakeholders drew on different parts of the report to support competing narratives, and the broader conflict persisted.

2010s: Common Core and Renewed Controversy

The 2010 release of the Common Core State Standards for Mathematics (CCSS-M) framed mathematical rigor as a three-part emphasis on conceptual understanding, procedural skill and fluency, and application.[16] In many places, implementation became a flashpoint that revived familiar tensions. Some traditional-leaning critics argued that CCSS-M-aligned materials delayed standard algorithms and relied heavily on visual representations, while reform-oriented voices emphasized conceptual understanding and application and warned against a return to "drill-and-kill" instruction.[17] Unfamiliar strategies and terminology frustrated many parents, sparking public controversies that, amplified by social media, became entangled with broader political backlash.[18] In response, some states renamed or revised their standards, often preserving substantial alignment with CCSS-M, and many underlying disagreements persisted.[19]

2020s: The Emergence of the Science of Math

Catalyzed by stagnant pre-pandemic student performance and inspired by the Science of Reading, the Science of Math movement officially formed in December 2020 and gained traction throughout 2021.[20] Led primarily by researchers from special education and school psychology, the movement emphasizes using empirical evidence, particularly from quantitative research, to guide classroom practice and pushes back against what it considers

13. National Mathematics Advisory Panel, "Final Report," xiii-xvi.

14. Ibid., xix, 26.

15. Ibid., xxii, 45.

16. Common Core State Standards Initiative, "Mathematics Standards."

17. Garelick and Zimba, "The Problem of Instructional Time."

18. Time Magazine, "Dad's Rant About Common Core."

19. Achieve Inc., "Strong Standards," 2-5.

20. Barshay, "Proof Points"; Codding, Peltier, and Campbell, "Introducing the Science of Math," 6-7.

“pseudoscientific” practices in math instruction.[21] It specifically advocates for systematic, explicit instruction, regular practice to achieve automaticity, multi-tiered systems of support (MTSS), and data-based decision-making.[22] While aligned with traditionalist priorities like teacher-led instruction, the movement maintains that it does not promote rote memorization at the expense of meaning.[23] Drawing on the National Research Council’s five intertwined strands of mathematical proficiency and the recommendations of the NMAP, it argues that conceptual understanding and procedural fluency develop bidirectionally and simultaneously, directly challenging the view that conceptual understanding must always precede procedural practice.[24] Critics from the reform and general mathematics education communities have raised serious concerns about the movement’s citational practices, its narrow definition of evidence, and the generalizability of its claims, objections we examine later in this guide.[25] The emergence of this movement has thus opened a new front in the Math Wars: a fundamental dispute over what constitutes valid scientific evidence and how it should guide mathematics instruction.[26]

21. NCSM, “Strengthening Research-informed Decision Making,” 3-5; Codding, Peltier, and Campbell, “Introducing the Science of Math,” 7.

22. Powell et al., “Essential Components of Math Instruction,” 14-24; Codding, Peltier, and Campbell, “Introducing the Science of Math,” 10.

23. Barshay, “Proof Points.”

24. Codding, Peltier, and Campbell, “Introducing the Science of Math,” 8; Powell, Hughes, and Peltier, “Myths That Undermine Math Teaching,” 2; Rittle-Johnson, Schneider, and Star, “Not a One-Way Street,” 587-597.

25. NCSM, “Strengthening Research-informed Decision Making,” 3-7; Cohen, Jones, and Gibbons, “The Missing Middle?,” 3-4.

26. Barshay, “Proof Points”; Cohen, Jones, and Gibbons, “The Missing Middle?,” 1-3.

THE "NEW" MATH WARS: FIVE DICHOTOMIES AND THE SCIENCE OF MATH

At this point, we can begin to understand why the Math Wars seem both "new and old" and why the current debate around the Science of Math movement can feel so charged and personal. At first glance, many of the new debates surrounding explicit instruction or procedural fluency versus conceptual understanding appear to recycle old divisions based on traditionalists' and reformers' preferences for teacher-led versus student-centered approaches to teaching and learning. And indeed, Dewey's **pedagogical divide** represents a fundamental belief capable of explaining at least some of the Math Wars' more recent intensity: a person viewing the child as the starting point of all education who learns best by discovering mathematics with minimal teacher guidance would have very little in common with an advocate for teacher-led explicit instruction.

Yet the gap between the two sides is not as wide as the headlines suggest. In practice, many traditionalists and reformers occupy **overlapping territory** rather than opposite ends of an unbridgeable divide. Most traditionalists do not reject conceptual understanding; they contest its sequencing relative to procedural fluency. Most reformers do not reject explicit instruction outright; they contest its scope, warning that it should not crowd out inquiry, problem-solving, and sensemaking. Both sides also share several **broad commitments**: that students need both fluency and understanding, that learners vary in their needs, and that teachers require stronger preparation and support.

Those areas of overlap matter. They suggest that many recurring disputes in the Math Wars are not pure either/or choices. At the same time, the disagreements are still real. They focus on *when* to introduce specific practices, *how* broadly to apply them, and *what* kinds of evidence should guide classroom and policy decisions. The result is not a manufactured conflict, but a debate in which **overlap coexists with durable differences** over sequence, default pedagogy, and evidentiary standards.

Those durable differences have been reinforced by **institutional inertia** on both sides. Over decades, each camp has built advocacy networks, professional communities, and curricular ecosystems that tend to circulate and validate their own preferred arguments. That history helps explain why recurring disputes can feel larger, sharper, and more settled within each camp than they often appear from a broader vantage point.

Toward the **traditional** end of the spectrum, we have historical figures (e.g., James Milgram, Richard Askey) and contemporary contributors to recent debates, such as those related to California's math framework (e.g., Brian Conrad, Jelani Nelson) or to advocate for the Science of Math movement (e.g., Sarah Powell). Traditional-leaning approaches are further supported by organizations (e.g., American Mathematical Society [AMS], Mathematically Correct, and NYC HOLD) and featured in programs, such as *Saxon Math* and *Singapore Math*. Toward the **reform** end of the spectrum, we also have historical figures (e.g., Tom Romberg, Glenda Lappan) and contemporary contributors to recent debate on topics such as equity versus excellence (e.g., Alan Schoenfeld, Phil Daro), problem-based learning (e.g., Dan Meyer), or critique of the Science of Math movement (e.g., Jo Boaler). Reform-oriented approaches have garnered long-standing support from NCTM and the Association of Mathematics Teacher Educators (AMTE), alongside historical funding support from the National Science Foundation (NSF) for prominent reform programs, such as *Investigations in Number, Data, and Space*; *Connected Mathematics Project*; *Core-Plus Mathematics*; and *Illustrative Mathematics.*

These closely knit networks have reinforced what Julie Cohen and colleagues call "epistemic bunkers," insulated communities that grant greater credibility to evidence generated within their own ranks while discounting outside perspectives, often justified by differences in methodology, theoretical orientation, or professional culture. This selective engagement can narrow the scope of inquiry, stifle innovation, and entrench preexisting assumptions. Structural barriers, such as separate conferences, publication venues, and professional networks, further **limit opportunities for meaningful dialogue** across divides. The result is often a fragmentation of knowledge that produces incoherent or incomplete guidance for practice,[27] undermining the development of well-rounded solutions and, ultimately, constraining the impact of research on the people and problems it aims to address.[28]

With this perspective in mind, we are now ready to examine several **instructional dichotomies** that have emerged in the "new" Math Wars of recent years. Rather than focusing on abstract academic debates about methodology or epistemology, we examine tensions that directly affect classroom teaching. These disputes are examined at some length because they are often treated too shallowly in public commentary, and the resulting oversimplification has real consequences for policy, curriculum, and classroom practice. For each dichotomy, we clarify where the current disagreement lies, often around emphasis, sequence, or instructional default rather than a simple either/or choice, and then present the traditional and reform ends of the debate spectrum. A word of caution: those positions are deliberately "pure,"

27. Cohen, Jones, and Gibbons, "The Missing Middle?," 1-2.

28. Ibid.," 4, 9.

representing each side's main arguments and commonly cited evidence. Practitioners and researchers rarely hold these views in their entirety; they are meant to help readers recognize the traditional or reform orientation of arguments they will encounter in the field, not to describe how any individual or organization actually thinks. Both sides invoke research in support of their claims, and we cite that evidence as reported, without adjudicating the underlying bodies of literature, a task well beyond the scope of this guide. The Science of Math movement is the exception to this overall approach. Because the movement's positions have attracted significant public attention and are frequently described in reductive terms, we present the movement's stated stances on each dichotomy so readers can evaluate its claims firsthand. The objections that reform-oriented organizations have raised about the movement are examined in greater detail at the end of the section.

Conceptual Understanding vs. Procedural Fluency

The Divide: For decades, math education has wrestled with whether to prioritize deep conceptual understanding or mastery of procedures and facts. While two major panel reviews of mathematics research have addressed this issue by noting that an "integrated and balanced development"[29] was needed and that "for all content areas, conceptual understanding, computational fluency, and problem-solving skills are each essential and mutually reinforcing,"[30] their **instructional sequence** remained unclear. In 2014, NCTM reignited this debate by issuing a *conceptual-first* recommendation, emphasizing that "procedural fluency follows and builds on a foundation of conceptual understanding, strategic reasoning, and problem solving"[31] as part of effective mathematics teaching. Therefore, the current divide is not about choosing between teaching concepts or procedures, but about which to start with *first*.

The Sides: On the reform end, advocates of a conceptual-first approach argue that students should grasp underlying mathematical ideas (e.g., place value, number magnitude) before learning formal procedures. They worry that rote execution of algorithms without understanding leads to "**fragile knowledge**," meaning that students may produce correct answers but cannot explain why or apply their knowledge flexibly.[32] Some influential frameworks, including the Common Core and NCTM's *Principles to Actions*, have reflected this concern, citing research that supports a conceptual-first approach based on better

29. National Research Council, "Adding It Up," 11.

30. National Mathematics Advisory Panel, "Final Report," 30.

31. NCTM, "Principles to Actions," 42.

32. Burrill, "Mathematics Education," 29.

retention of procedures[33] and studies that suggest a "rush to fluency" is a cause of math anxiety and undermines students' confidence and interest in math.[34] In this view, procedural fluency, or the efficient, accurate execution of operations, is valuable, but only *after* a strong conceptual foundation has been laid.

On the traditional end, proponents of procedural fluency contend that mathematics has a structure and a sequential skill hierarchy that demand mastery of the basics. In this view, the ability to execute procedures accurately and automatically (e.g., knowing multiplication tables or the standard algorithm for subtraction by heart) is foundational. They argue that mastering arithmetic facts and algorithms **frees up working memory** for complex problem-solving and point to evidence that suggests fast and accurate recall of arithmetic facts can be achieved independently of conceptual knowledge.[35] Students may find it challenging to grasp algebraic concepts, for instance, if they continue to struggle with arithmetic.

The Science of Math. The Science of Math movement challenges the idea that educators must teach one before the other, opposing NCTM's stance by pointing out that current research does, in fact, *not* support "claims about an instructional sequence (e.g., conceptual before procedural) that leads to improved student outcomes."[36] Instead, proponents highlight research showing that **conceptual and procedural knowledge develop together**, each reinforcing the other, and how, when taught simultaneously, they strengthen each other.[37] Introducing the concept of regrouping (conceptual) alongside the standard addition algorithm (procedural), for example, allows students to see how the procedure embodies place-value principles. In a 2015 review, Rittle-Johnson and colleagues concluded that available evidence supports a **bidirectional relationship** "with improvements in procedural knowledge often supporting improvements in conceptual knowledge as well as vice versa. It is not a one-way street from conceptual knowledge to procedural knowledge; the belief that procedural knowledge does not support conceptual knowledge is a myth."[38] More recent findings from the cognitive and developmental sciences also support a **mutually beneficial, complementary, and intertwined relationship** between arithmetic fluency and conceptual understanding. McNeill and colleagues noted that a meaning-related component (e.g., numeracy, number sense, conceptual knowledge

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33. Fuson, Kalchman, and Bransford, "Mathematical Understanding: An Introduction," 236.

34. Ashcraft, "Math Anxiety: Personal, Educational, and Cognitive Consequences," 184; Ramirez et al., "Math Anxiety, Working Memory, and Math Achievement," 193-195.

35. Delazer and Benke, "Arithmetic Facts Without Meaning," 707-708.

36. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 2.

37. Powell et al., "The NCTM/CEC Position Statement," 12.

38. Rittle-Johnson, Schneider, and Star, "Not a One-Way Street," 594.

of arithmetic) serves as a precursor, laying the foundation for memorizing symbolic arithmetic facts. Simultaneously, fluency frees up cognitive resources, allowing for deeper reflection, concept building, and the discovery of new strategies, thereby enhancing conceptual understanding. This dynamic creates a **cyclical, reinforcing process** where proficiency in simpler tasks supports understanding of more complex material, which in turn strengthens foundational knowledge, leading to "fluency with understanding" as a central goal.[39]

Standard Algorithms vs. Invented Strategies

The Divide: This prominent fault line centers on *when* students should learn standard step-by-step procedures for arithmetic operations and *when* they should develop their own invented strategies. As such, the debate is about the **timing** of introducing standard algorithms: should teachers introduce student-devised strategies (to surface place-value reasoning and flexibility) before formalizing a standard algorithm, or teach the standard algorithm early and then cultivate strategic flexibility around it? The "algorithms-later" stance arose partly from worries that the compact, abstract procedures of algorithms can obscure place-value concepts and encourage rote execution without comprehension; the counter-concern is that delaying the adoption of reliable methods keeps many students stuck in slow or error-prone approaches.

The Sides: On the reform end, advocates often favor delaying the adoption of formal algorithms in favor of student-devised strategies. They stress the importance of guiding children to invent, share, and refine their own computational methods, arguing that this process fosters a **deeper understanding** of numerical relationships and operations.[40] From this perspective, introducing standard algorithms too soon may cause students to "give up their own thinking" and merely apply rules by rote, thereby *unteaching* place-value understanding and hindering the development of number sense.[41] Proponents of this side point to research findings showing that students who used invented strategies for multi-digit addition and subtraction before learning the standard algorithm demonstrated better understanding of the base-ten system and greater success on new problems than those taught the algorithm first.[42] Some advocates have further expressed concerns about students *memorizing* standard algorithms,

39. McNeil et al., "What the Science of Learning Teaches Us," 12, 39.

40. Carpenter et al., "A Longitudinal Study," 4, 18.

41. Kamii and Dominick, "To Teach or Not to Teach Algorithms," 51, 58.

42. Carpenter et al., "A Longitudinal Study," 3, 14, 16.

especially under *timed practice*, which they view as detrimental to students, undermining their sensemaking and potentially causing anxiety or trauma.[43]

On the traditional end, advocates argue that standard algorithms are indispensable tools that all students should master, and that withholding them too long may do more harm than good. From this perspective, algorithms are **efficient and generalizable methods** that reliably produce accurate results.[44] Teaching them is viewed not as rote memorization but as equipping students with effective techniques, ideally accompanied by an explanation of why they work.[45] Traditionalists point out that most of the invented strategies students come up with are either intuitive applications of place value or simplified versions of the standard algorithms.[46] While such exploration has value, it should not replace the explicit teaching of the standard methods. They also cite practical and **equity-based concerns**: without clear instruction, students who do not intuitively develop efficient strategies on their own (often those already struggling or lacking support at home) can be left floundering or resorting to inefficient tactics well into later grades.[47]

The Science of Math. The Science of Math movement rejects the “myth” that teaching standard algorithms is harmful, arguing that this claim rests on flawed or methodologically weak research.[48] Instead, the movement promotes explicitly teaching **standard algorithms alongside their conceptual meaning** to ensure students know when and how to apply them efficiently.[49] In alignment with traditionalists, advocates point to findings across numerous studies, which suggest that the teaching of efficient procedures generally produces better overall achievement than expecting learners to discover or apply procedures unaided.[50] In the context of arithmetic, studies have documented clear benefits to ensuring students learn the standard algorithms. One study showed that after a year of practicing a standard algorithm, children of all ability levels could execute it correctly and overwhelmingly

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43. Boaler, “Research Suggests,” 469-470, 473.

44. Norton, “The Use of Alternative Algorithms,” 2-5; Fischer et al., “Should We Continue,” 107; Son, “Moving Beyond a Traditional Algorithm,” 122-123, 127; Torbeyns and Verschaffel, “Mental Computation or Standard Algorithm?,” 108, 111.

45. Osana, Adrien, and Duponsel, “Effects of Instructional Guidance,” 18; Norton, “The Use of Alternative Algorithms,” 18-22.

46. Norton, “The Use of Alternative Algorithms,” 18-22.

47. Powell, Hughes, and Peltier, “Myths That Undermine,” 3-5; Son, “Moving Beyond a Traditional Algorithm,” 126; Norton, “The Use of Alternative Algorithms,” 18-22.

48. Powell, Hughes, and Peltier, “Myths That Undermine,” 3.

49. Ibid., 3.

50. Kirschner, Sweller, and Clark, “Why Minimal Guidance,” 76; Alfieri et al., “Does Discovery-Based Instruction,” 1, 6.

chose to use it when given a choice. In contrast, children who had not been taught an algorithm often resorted to ad hoc methods that were slow or error-prone.[51] Similarly, a comparative study found that across addition, subtraction, multiplication, and division problems, students who applied the standard algorithms were significantly more likely to reach correct answers than those using alternative, self-devised strategies.[52]

Inquiry-Based Instruction vs. Explicit Instruction

The Divide: Perhaps the most divisive issue in the Math Wars is the debate over how much guidance teachers should provide. Returning to Dewey, this divide centers on which **pedagogical approach** to emphasize in math instruction. One approach focuses on inquiry-based instruction, often characterized by student-centered exploration, problem-based learning, and discovery. It posits that students learn best by constructing their own knowledge through rich tasks, open-ended problems, and minimal direct instruction, with the teacher serving as a facilitator rather than an instructor. The other approach emphasizes explicit (direct) instruction: teacher-led, structured practice that involves clear teaching of procedures and concepts, step-by-step demonstrations, guided practice, and immediate feedback.[53] The contemporary divide adds more complexity to the argument, including the question of *to what end* these approaches are best applied (i.e., deep learning or efficient learning) and *for whom* (i.e., struggling learners or high achievers).

The Sides: On the reform end, proponents of inquiry-based instruction argue that students develop deeper conceptual understanding and transferable skills when they actively investigate mathematical principles.[54] They point out that when learners engage in solving authentic problems, form hypotheses, and grapple with ideas, the result is more meaningful learning.[55] They often highlight the successes of reform-oriented curricula, citing meta-analyses of the prominent "inquiry-rich" standards introduced in the 1990s, which demonstrate that *guided inquiry* approaches consistently outperform traditional direct instruction in fostering conceptual understanding.[56] While early models of inquiry-based instruction often portrayed teachers as passive

51. Torbeyns and Verschaffel, "Mental Computation or Standard Algorithm?," 111.

52. Norton, "The Use of Alternative Algorithms," 18-22.

53. See Appendix A for a glossary of key terms.

54. Alfieri et al., "Does Discovery-Based Instruction Enhance Learning?," 1; Kamii and Dominick, "To Teach or Not to Teach Algorithms," 60.

55. Alfieri et al., "Does Discovery-Based Instruction Enhance Learning?," 2; Lazonder, "Inquiry-Based Learning," 630.

56. Alfieri et al., "Does Discovery-Based Instruction Enhance Learning?," 1; Furtak et al., "Experimental and Quasi-Experimental Studies of Inquiry-Based Science Teaching," 301-302, 320.

facilitators during *unguided* discovery, most contemporary reform advocates contend that significant learning occurs when students solve authentic problems, formulate hypotheses, and evaluate evidence under a teacher's active and structured guidance.[57] They also credit inquiry-based methods for enhancing student engagement and curiosity, citing studies that show regular participation in these activities correlates with a growth mindset, viewing math as a creative, useful, and inherently interesting subject rather than as innate talent.[58]

On the traditional end, advocates of systematic, explicit instruction caution that unguided discovery, especially for novices, is inefficient and can lead to misconceptions.[59] They draw on evidence from cognitive science that working memory is limited and that minimal guidance during instruction places an undue cognitive load on learners.[60] Kirschner and colleagues, for example, concluded that instructional approaches with little guidance ignore human cognitive architecture, and that evidence from half a century of controlled studies "almost uniformly supports direct, strong instructional guidance rather than constructivist-based minimal guidance."[61] Building on this, traditionalists maintain that explicit teaching is an absolute prerequisite for novice learners attempting to acquire novel schemas, as they lack the foundational knowledge necessary to process open-ended tasks.[62] Furthermore, traditionalists note that when "guided" discovery models do prove successful, it is precisely because they incorporate the core features of explicit instruction, such as setting clear goals, providing scaffolding, and offering timely feedback.[63]

This debate came to a head in 2022 when Zhang et al. argued there was an "evidence crisis in science educational policy," contending that standards documents had overemphasized inquiry learning while ignoring randomized controlled trials and correlational research favoring explicit instruction for novices.[64] De Jong and colleagues countered that Zhang et al. had selectively read the evidence, and that guided inquiry, not the unguided discovery under

57. Furtak et al., "Experimental and Quasi-Experimental Studies of Inquiry-Based Science Teaching," 323-324; Lazonder, "Inquiry-based learning," 631-632.

58. Pedersen and Haavold, "Students' mathematical beliefs and motivation," 1650-1652, 1656; Lazonder, "Inquiry-Based Learning," 631.

59. Kirschner, Sweller, and Clark, "Why Minimal Guidance During Instruction Does Not Work," 78; Clark, Kirschner, and Sweller, "Putting Students on the Path to Learning," 8.

60. Kirschner, Sweller, and Clark, "Why Minimal Guidance During Instruction Does Not Work," 79; Sweller, van Merriënboer, and Paas, "Cognitive Architecture and Instructional Design," 261-262.

61. Kirschner, Sweller, and Clark, "Why Minimal Guidance During Instruction Does Not Work," 76, 83.

62. Sweller et al., "Response to De Jong et al.'s (2023) paper," 3; Clark, Kirschner, and Sweller, "Putting Students on the Path to Learning," 9.

63. Alfieri et al., "Does Discovery-Based Instruction Enhance Learning?," 1; Mayer, "Should There Be a Three-Strikes Rule," 15; de Jong et al., "Let's talk evidence," 4.

64. Zhang et al., "There is an Evidence Crisis in Science Educational Policy," 1157, 1159, 1164-1165.

critique, was well-supported for building conceptual knowledge.[65] Notably, de Jong et al. did not defend inquiry as a universal default, instead calling for moving beyond "which approach is better" toward understanding how both methods can be most effectively combined depending on learning goals, content domain, and students' prior knowledge.[66]

The Science of Math: Proponents of the Science of Math movement call for a context-dependent blend that strongly emphasizes **systematic, explicit instruction** in foundational content, particularly for novice and struggling learners.[67] They push back against equating this evidence-based practice with conventional teacher lectures, arguing it is a rigorous and nuanced practice that includes (a) teaching concepts in a developmentally sequenced way, (b) integrating conceptual and procedural knowledge with real-world applications, and (c) using ample practice with corrective feedback to strengthen long-term learning.[68] Drawing on **cognitive load theory**, they note that novices have limited capacity to juggle many unknowns at once, making unguided inquiry likely to overload cognitive resources.[69] The movement does not reject guided inquiry outright, but challenges the notion that it should be treated as the default approach.[70] What works best, they contend, depends on students' prior knowledge and the complexity of the material.[71]

Productive Struggle vs. Scaffolded Support

The Divide: This adjacent debate centers on the **roles of struggle and support** in learning mathematics. Should students wrestle with difficult problems, possibly risking mistakes or frustration, or should teachers scaffold and support them to ensure success? On closer examination, the disagreement is less about whether struggle or support matters and more about *how* much of each is instructionally productive, for *whom*, and *when*. Reform math circles have popularized the term "productive struggle," and in 2014, NCTM further elevated its role in mathematics instruction by adding it to its list of eight effective teaching practices.[72]

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65. de Jong et al., "Let's talk evidence," 1, 3-4.

66. de Jong et al., "Let's talk evidence," 1, 4-5; de Jong et al., "Beyond inquiry or direct instruction," 1-2.

67. Powell et al., "The NCTM/CEC position statement," 13; Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 4-5; Powell et al., "Essential Components of Math Instruction," 23.

68. Powell et al., "The NCTM/CEC position statement," 14.

69. Ibid.,11, 14.

70. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 4-5; Powell et al., "The NCTM/CEC position statement," 14.

71. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 5; Powell et al., "The NCTM/CEC position statement," 14.

72. NCTM, "Principles to Actions," 48-52.

The Sides: On the reform end, proponents argue that productive struggle is a crucial element for effectively learning mathematics and understanding mathematical concepts. They point to studies where engaging with complex, targeted problems before formal instruction, even if it leads to initial failure, resulted in **better conceptual understanding and skill transfer** compared to direct instruction alone.[73] Moreover, they contend that encountering and overcoming challenges develops students' perseverance, resilience, and deeper insight.[74] In *Principles to Actions*, NCTM points to work by Stanford psychologist Carol Dweck, whose research popularized the idea of a "**growth mindset**," arguing that math teachers "must accept that struggle is important to students' learning of mathematics" and refrain from immediately helping students when they get stuck.[75] To ensure this effort leads to meaningful sense-making rather than mere frustration, advocates of productive struggle contend that teachers must carefully frame the struggle and facilitate student thinking without taking over the cognitive work.[76] Productive struggle, in their view, is not about abandoning students but rather about using strategic questioning and support to help them build on their own ideas.[77]

On the traditional end, proponents of **scaffolded support** caution that too much struggle can quickly become unproductive, leading to frustration, anxiety, and misconceptions.[78] They emphasize the teacher's role in providing just enough support, such as hints, prompts, or breaking tasks into smaller steps, so that students can make progress with reasonable effort, with that support gradually withdrawn as competence grows.[79] They cite research showing that effective instruction moves from easier to more difficult content in manageable chunks, with varying levels of scaffolding provided along the way, and that teacher-led instructional scaffolding, including guided practice, gradual release, and the integration of multiple techniques, produces statistically significant improvements compared with conventional methods.[80] This approach is grounded in Vygotsky's concept of the Zone of Proximal Development, which locates productive learning in the space between what

73. Kapur, "Productive Failure in Learning Math," 1008; Warshauer, "Productive struggle in middle school mathematics classrooms," 375; Bolyard et al., "Learning to Struggle," 3.

74. Chen et al., "Navigating student uncertainty for productive struggle," 1100.

75. NCTM, "Principles to Actions," 50; Salazar, "Influence of Productive Struggle," 81, 87; Bolyard et al., "Learning to Struggle," 2.

76. Weingarden, "Exploring pre-service mathematics teachers' perspectives," 2, 5.

77. Warshauer, "Productive struggle in middle school mathematics classrooms," 379; Bolyard et al., "Learning to Struggle," 10.

78. van Merriënboer and Sluijsmans, "Toward a Synthesis of Cognitive Load Theory," 55, 57.

79. Nwoke, "Impact of Instructional Scaffolding Approach," 47; Khan et al., "Effect of Scaffolding Teaching Method," 48.

80. van Merriënboer and Sluijsmans, "Toward a Synthesis of Cognitive Load Theory," 57; Nwoke, "Impact of Instructional Scaffolding Approach," 48-49; Khan et al., "Effect of Scaffolding Teaching Method," 50.

a student can do independently and what they can achieve with skilled guidance.[81] Building on this foundation, proponents warn that allowing novice learners to struggle without adequate support can erode their confidence and waste valuable instructional time.[82]

The Science of Math: The movement's stance on this debate centers on the **practical challenge** of teachers being able to reliably pinpoint the right amount of challenge before productive struggle turns into "destructive struggle."[83] They argue that what makes a task "hard" is the application of skills students do not yet have, which is viewed as an **ineffective use of instructional time**, and that perseverance, while important, is not a substitute for systematic, explicit instruction of needed strategies.[84] Moreover, advocates note a **lack of research** supporting the notion that struggling with a math concept increases students' problem-solving processes in ways that improve achievement outcomes.[85] Notably, this claim stands in tension with the productive failure research cited above, reflecting a deeper disagreement not only about what to recommend but about what the existing evidence actually shows. Proponents instead point to a range of evidence-based practices that they argue more reliably improve outcomes, especially for novice and struggling learners (e.g., using multiple representations, developing word-problem-solving skills). One such approach is **self-regulated strategy development** (SRSD), an explicit teaching method that helps students plan, monitor, and evaluate their approach to multi-step problems. Research shows SRSD and similar scaffolds can improve problem-solving performance by making the process visible and coaching students through difficulties.[86] Science of Math proponents also caution against equating productive struggle with the development of a growth mindset and against using standalone growth mindset interventions, given a lack of strong empirical support.[87] While noting that growth mindset interventions may benefit specific high-risk populations, Sisk and colleagues concluded that overall effects on academic performance fell well below the average of other educational interventions, and that "from a practical perspective, resources might be better allocated elsewhere."[88]

81. Nwoke, "Impact of Instructional Scaffolding Approach," 47; Khan et al., "Effect of Scaffolding Teaching Method," 48.

82. van Merriënboer and Sluijsmans, "Toward a Synthesis of Cognitive Load Theory," 57.

83. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 5; Murdoch et al., "Feeling Heard," 663-664.

84. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 5.

85. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 5; Powell et al., "Essential Components of Math Instruction," 14, 20.

86. Popham, Adams, and Hodge, "Self-Regulated Strategy Development," 155.

87. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 6.

88. Sisk et al., "To What Extent," 569.

Timed Practice vs. Math Anxiety

The Divide: The final, instructionally relevant, and heated Math Wars debate concerns the extent to which timed tests and drills induce math anxiety and whether they should be avoided or handled with extreme care as a result. This divide has been amplified by influential figures like Jo Boaler, who claimed that "evidence strongly suggests that timed tests cause the early onset of math anxiety."[89] Her stance and the backlash from others have essentially made this debate a proxy battle in the new Math Wars, symbolizing bigger philosophical differences about what math fluency means and how to achieve it.

The Sides: On the reform end, critics of timed testing emphasize the emotional toll and potential harm of putting students under time pressure in math. They point out that a significant number of adults report disliking or fearing math, often tracing this back to negative experiences with timed drills in elementary school.[90] Boaler has argued, based on student self-reports, that in at least one-quarter of students, timed math tests have been reported as the spark of math anxiety.[91] She and others contend that when young children are made to race through math problems, it can induce stress responses that block working memory and hence performance.[92] This can create a vicious cycle: a student under stress performs poorly, concludes "I'm bad at math," and then develops anxiety that persists. In short, critics argue that **timed testing is not an innocuous practice**, as it can fundamentally shape a student's mindset about math. Those on this side of the argument often advocate for **untimed assessments**, focusing on accuracy and strategy over speed. They redefine fluency not as fast recall under pressure, but as **efficient retrieval in a low-stress context** or simply "ease and accuracy" without an explicit speed component.[93] Furthermore, they argue that speed is not relevant to many higher-order math tasks; hence, they advocate for classroom practices such as "math talks" for fact fluency, the use of games or engaging activities, and allowing students to solve problems at their own pace to build confidence.[94]

On the traditional end, proponents of timed practice agree that math anxiety is a concern, but they contend that blaming timed tests is misguided. They see math fact fluency as crucial and timed practice as an effective means to build speed and accuracy.[95] Drawing from cognitive science, they contend that if students can recall basic facts automatically, then they free up working

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89. Boaler, "Research Suggests," 469.

90. Ibid., 469.

91. Ibid., 470.

92. Boaler, "Research Suggests," 470; Beilock, "Math Performance in Stressful Situations," 339-341.

93. Boaler, "Research Suggests," 471, 473.

94. Ibid., 471-473.

95. Maki et al., "Math Anxiety in Elementary Students," 101316.

memory for complex problem-solving.[96] As such, timed drills are essentially a form of *retrieval practice* that strengthens memory traces. Advocates argue that there is **no causal evidence** linking timed tests to lasting math anxiety.[97] They point to studies that show timed tests tend to impair mathematical performance rather than directly causing math anxiety, and that factors such as working memory, task complexity, and self-efficacy mediate the impact of timed testing on performance.[98] While proponents of timed testing criticize practices such as public score posting, strict time cutoffs for all students regardless of readiness, and the use of timed tests as high-stakes exams or as a form of punishment, they argue that these practices are not inherent to timed testing.[99]

The Science of Math: While acknowledging that math anxiety can prevent students from demonstrating their knowledge, interfere with working memory, and negatively impact achievement,[100] Science of Math advocates also claim that there is "no causal evidence that timed assessments will produce mathematics anxiety."[101] Timed drills that impose rigid time limits, invite public comparisons, or carry punitive stakes are counterproductive, whereas timed practice administered in a low-pressure, individualized manner, such as having students try to beat their own past score, can feel motivating and even game-like.[102] Timed assessment in curriculum-based measurement is a data-collection method for measuring fluency, and numerous studies have linked fluency practice to improved basic skills.[103] They further argue that avoiding timed exercises entirely can backfire: if students never develop quick recall, slow and effortful calculation in later coursework can itself generate frustration and anxiety through cognitive overload.[104] Appealing to cognitive load theory, they note that students who have not internalized basic facts will have fewer working memory resources available for complex tasks.[105] On this view, timed practice is not a source of anxiety but a **preventative measure**, building the foundational fluency students need to approach higher mathematics with confidence.[106]

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96. Ashcraft and Krause, "Working Memory, Math Performance, and Math Anxiety," 244.

97. Maki et al., "Math Anxiety in Elementary Students," 101316.

98. Tsui and Mazzocco, "Effects of Math Anxiety and Perfectionism," 132, 138; Caviola et al., "Stress, Time Pressure," 1488.

99. Ashcraft, "Math Anxiety," 184; Caviola et al., "Stress, Time Pressure," 1488.

100. Wang et al., "Is Math Anxiety Always Bad for Math Learning?," 1863, 1873.

101. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 8.

102. Ibid., 8-9.

103. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 8; Powell et al., "The NCTM/CEC Position Statement," 16.

104. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 8-9.

105. Ibid., 8.

106. Powell et al., "The NCTM/CEC Position Statement," 16; Merlo, "The Science of Maths," 8-9.

Evaluating the Science of Math Debate

The preceding dichotomies reveal a recurring pattern: the Science of Math entered the Math Wars as a movement hoping to resolve its disputes through "objective evidence," yet the movement has itself become one of the Math Wars' most contested new fronts. The most direct critiques have come from two 2025 **position statements** representing several prominent mathematics education organizations, most notably NCSM, AMTE, and NCTM. Taken together, those statements raise **three broad concerns:** that the Science of Math should not be treated as the mathematics equivalent of the Science of Reading;[107] that the movement has sometimes used research selectively or imprecisely;[108] and that its public-facing emphasis on explicit instruction risks advancing too narrow a view of mathematics teaching.[109]

At the time of publication, the leading authors of the Science of Math movement had not issued a formal response to either statement. Their published work does, however, provide a sufficiently detailed set of positions across the dichotomies examined in this guide to allow a limited assessment. What follows is therefore not an adjudication of the underlying research literatures, but an evaluation of how well those three criticisms match the movement's published positions as presented here.

First, the criticism that the Science of Math is not equivalent to the Science of Reading appears well-founded. Given that the movement is only a few years old and describes itself as a "constantly growing body of knowledge," a **maturity gap** between the two is to be expected. The more relevant consideration, however, is not whether the movement's founders reflect a broad interdisciplinary coalition, but whether its *arguments* and *recommendations* actually draw on more than one research tradition. On that narrower point, its published work extends beyond its home disciplines of special education and school psychology to engage with cognitive science, developmental psychology, and the learning sciences.

Second, NCSM's citational critiques identify several instances where the movement's public-facing claims appear to outrun careful citation and generalization. Any movement that adopts the mantle of science carries a heightened obligation to represent sources accurately and to mark the boundaries of its claims. At the same time, the critique is itself somewhat selective because it draws exclusively on website materials and condensed teacher-facing documents rather than on peer-reviewed articles and research

107. NCSM, Strengthening Research-informed Decision Making, 3; AMTE, Evidence-Based Math Instruction, 1.

108. NCSM, Strengthening Research-informed Decision Making, 3-4.

109. NCSM, Strengthening Research-informed Decision Making, 3, 5, 9; AMTE, Evidence-Based Math Instruction, 1.

reports in which the movement's more academic positions are developed. The broader concern about a narrow conception of evidence deserves partial concession but also qualification: qualitative research can illuminate classroom processes and student experience in ways experiments cannot, but large-scale instructional and policy recommendations also require **evidence capable of identifying causal effects**. The central issue, then, is not whether one method should displace all others, but how different forms of evidence should be weighed for different kinds of claims.

Finally, the movement's published positions complicate the charge that it treats explicit instruction as a simple one-size-fits-all solution. In its founding publication, the authors explicitly state that "there is no such thing as a 'one size fits all' evidence-based practice,"[110] and the positions summarized across the dichotomies in this guide generally support that claim. Its advocacy for explicit instruction is context-dependent, weighted toward novice and struggling learners, and tied to ideas such as expertise reversal rather than to a blanket rejection of guided inquiry.[111] Even so, the movement tends to engage more fully with evidence against *unguided* discovery than with evidence favoring teacher-guided and scaffolded inquiry, including forms that may in practice resemble its own recommendations more than its rhetoric sometimes suggests.[112] That asymmetry remains a fair target for criticism.

Stepping back, the broader picture is not one of a settled scientific center, but of an argument still being worked out across competing research communities. Each side can point to evidence in its favor, and even debates over what counts as rigorous evidence have become part of the conflict itself. That does not make the situation hopeless. It does mean, however, that teachers and the state and district leaders who support them need guidance in the interim, before consensus is achieved. In practice, these disputes reach classrooms first through policy levers such as legislation, curriculum requirements, and professional learning. The next section, therefore, examines how those levers have been used since the pandemic and what kinds of policy patterns are now emerging across states.

110. Codding, Peltier, and Campbell, "Introducing the Science of Math," 8.

111. Merlo, "The Science of Maths and How to Apply It," 18; Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 4-5.

112. Powell, Hughes, and Peltier, "Myths That Undermine Maths Teaching," 4; and Powell et al., "The NCTM/CEC Position Statement," 14.

CHANGING TIDES: THE SCIENCE OF MATH EMERGES IN STATE POLICIES

Tracking state legislation can be a moving target: bills are frequently amended, delayed, withdrawn, or reintroduced, and states vary in how quickly they publish enacted laws. Our scan of **state-level math policies** spans 2022 to late 2025 and includes only reforms we identified as actually enacted, whether through legislation or state board action.

Across the enacted policies in this scan, a recurring pattern is visible. Many recent reforms emphasize priorities also commonly associated with the Science of Math movement, including foundational numeracy, explicit and systematic instruction,[113] fluency, universal screening, tiered intervention, data-based decision-making, and professional learning tied to research.[114] This does not mean states have formally adopted the Science of Math as a framework, nor that these priorities belong exclusively to that movement. It does suggest, however, that post-pandemic math policy has moved in a more **structured, intervention-oriented direction**, especially in the early grades and in areas tied to screening, support, and instructional capacity.

Policy Momentum: Cumulative Adoption of Reading and Math Policies

Several state policies explicitly point to recent Science of Reading reforms as a reason to pursue similar changes in mathematics. The comparison is worth making, but it has limits. Reading and mathematics are not the same, and the differences matter for policy. Still, because states themselves are invoking reading as a model, the more useful question here is not whether the two movements are identical, but how quickly each has translated into state policy.

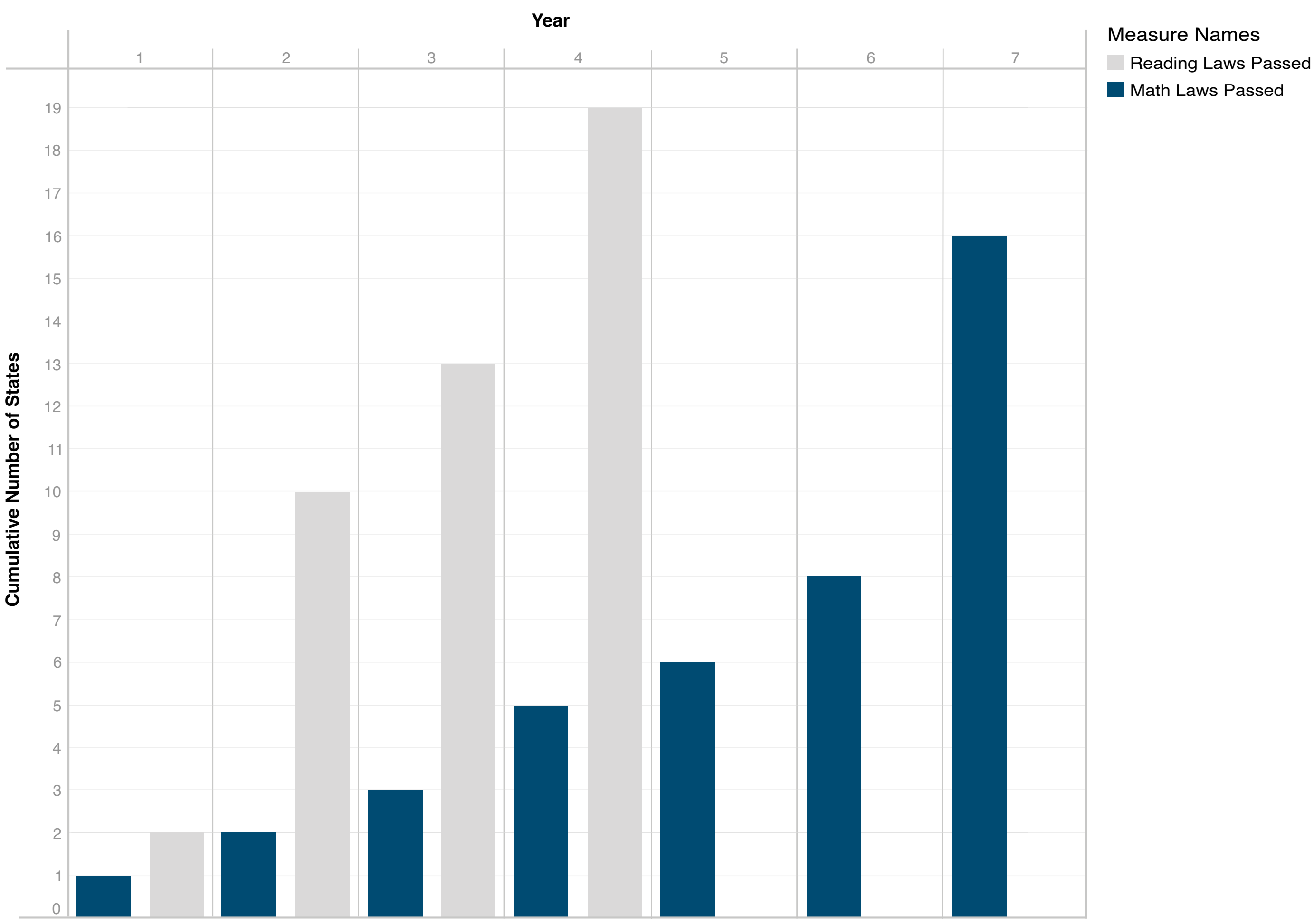
The early reading trajectory hereby sets the benchmark. As EdWeek's updated report on reading laws and policies shows, evidence-based reading laws spread slowly at first, with only one or two states enacting them each year from 2013 to 2018, before sharply accelerating starting in 2019 and peaking in 2023, when 17 states passed new reading legislation. That acceleration coincided with increasing criticism of balanced literacy and growing focus on systematic, explicit instruction in phonics and phonemic awareness, especially after Emily Hanford's 2022 *Sold a Story* podcast.

113. Codding, Peltier, and Campbell, "Introducing the Science of Math," 7-8; Powell et al., "Essential Components of Math Instruction," 15, 19.

114. Codding, Peltier, and Campbell, "Introducing the Science of Math," 9; Powell et al., "The NCTM/CEC Position Statement," 9-10.

Figure 1 compares the cumulative adoption of reading and math policies over their early years. The figure begins tracking reading laws in 2013 and math policies in 2022, when pandemic-related declines intensified concerns about math outcomes and the Science of Math began receiving broader public attention. The cumulative number of enacted policies is shown for each year. By that measure, math-related policies reflecting evidence-based priorities, many of them associated with the Science of Math, have accumulated more quickly than reading laws did at a comparable stage of Science of Reading policy adoption. At the same time, that finding should be read carefully: most of these math policies focus on foundational numeracy, screening, intervention, and other early-grade supports rather than the full breadth of K-12 mathematics.

Figure 1. Comparison of Cumulative Reading and Math Laws Passed



State-Level Math Policies: Scope and Priorities

Table 2 summarizes our state-by-state scan, noting the state, year, name, and general focus of the enacted policy, along with a simple visual indicator of how many Science of Math priorities each policy addressed. Based on a review of the movement's published works[115] and its website, we identified seven recurring priorities:

1. Foundational numeracy focus (K-5)
2. Universal screening in mathematics
3. Data-based decision making
4. Systematic, explicit instruction
5. High-quality instructional materials
6. Targeted intervention for struggling students, including systems like MTSS
7. Professional learning aligned to math education research

These seven priorities provide a useful lens for comparing what states have chosen to emphasize, but they do not represent the full range of considerations prioritized in state math policy. Other foci not captured by this framework, such as equitable access to advanced coursework, high-dosage tutoring programs, and family notification requirements, also drive policy in some states. The indicators in Table 2 should therefore be read as indicating alignment with a cluster of post-pandemic priorities, not as a comprehensive scorecard for state math policy. Readers interested in a formal review against a broader set of 11 math principles should consider ExcelinEd's state map.

By late 2025, 18 states plus the District of Columbia had enacted policies as shown in Table 2. While these priorities do not form a complete list or a formal framework, they offer a practical lens for comparing what states have chosen to emphasize. More details on each Science of Math priority and the various policies listed below can be found in Appendix B and Appendix C, respectively.

115. Codding, Peltier, and Campbell, "Introducing the Science of Math," 7-9; Powell et al., "Essential Components of Math Instruction," 15, 19; Powell et al., "The NCTM/CEC Position Statement," 9-10.

Table 2. ***Overview of Math Policies Between 2022 and 2025***

State & Year	Policy Name & Focus	Priorities Reflected
Alabama (2022)	Numeracy Act (K-5 foundational skills)	●●●●●●●
New Mexico (2022)	“Math is Me” Initiative and Tutoring Corps (K-8 interventions preparing for algebra)	●●●●●○○
West Virginia (2023)	Third Grade Success Act (K-3 math/literacy)	●●●●●○○
Arkansas (2023)	LEARNS Act (3-8 interventions)	●●●●○○○
Florida (2023; 2025)*	HB 7039 (K-4 supports & dyscalculia) F.S. 1008.25 (Early learning)	●●●●●●●
Colorado (2023)	HB 23-1231 (Evidence-Informed PD & grants)	●●●●●○○
Louisiana (2023)	Act 260 (Teacher PD - 50 hours)	●●●●●●●
Texas (2023; 2025)*	Texas SB 2124 (Middle School Advanced Math Enrollment) HB 2 and 8	●●●●●●●
Nevada (2023; renewed 2025)	AB 383 (High-dosage tutoring)	●●●○○○○
Mississippi (2023; 2025)*	Mathematics Proficiency and Intervention Act (Early intervention)	●●●●●○○
Kentucky (2024)	Numeracy Counts Act (Comprehensive K-12)	●●●●●●●
Tennessee (2024)	SB 1712 (Math PD & Analysis)	●●○○○○○
Washington, D.C. (2024)	Math Task Force, DC Math Hub (Post-pandemic recovery)	●●●○○○○
Indiana (2025)	Indiana House Enrolled Act 1634 (K-8 foundational skills)	●●●●●●○
Iowa (2025)	Math Counts Act (K-12 math reform)	●●●●●●●
Montana (2025)	HB 573 (Transformational learning)	●●●●●●○
Oklahoma (2025)	Oklahoma Math Achievement and Proficiency Act (Early identification and screening)	●●●●●●●
Virginia (2025)	22.1-207.9 — Advanced or Accelerated Mathematics Opportunities (Grades 5-8)	●●●○○○○
Maryland (2025)	Math Policy A: Statewide Mathematics Instruction and Intervention Framework (K-8 foundational skills & system capacity)	●●●●●●○

*Note: Second year indicates a substantive or new policy addition.

Table 2 suggests that recent state action is neither uniform nor scattered. The most common themes are **data-based decision making**, **high-quality instructional materials**, and **targeted intervention**. Foundational numeracy, universal screening, and systematic, explicit instruction also appear frequently, especially in broader K-5 or K-8 reforms. A smaller set of policies is narrower, focusing mainly on placement or access. By contrast, states such as Alabama, Maryland, Iowa, Kentucky, Mississippi, and Oklahoma adopted broader, **multi-component packages** that reflect virtually all Science of Math themes.

The policies in Table 2 also differ in emphasis. Alabama, West Virginia, and Arkansas concentrate on foundational skills and early support structures, including screening, intervention, coaching, and fluency-related goals. Florida and Kentucky place particular emphasis on identifying and supporting students with mathematics difficulties, including **dyscalculia**. Texas and New Mexico focus more narrowly on access to advanced courses. Another common strand is **teacher capacity**: Louisiana's 50-hour training requirement, Kentucky's certification changes, and Colorado's preservice reforms all reflect greater state investment in preparing teachers to teach mathematics more effectively.

Taken together, these policies point in a recognizable, though not uniform, direction. Many states have moved toward more structured and intervention-focused approaches commonly associated with the Science of Math, but they differ substantially in scope, intensity, and emphasis. Some policies center on foundational skills and early supports; others emphasize teacher capacity, access, or placement. The more defensible conclusion, therefore, is not that states are wholesale adopting a single instructional doctrine, but that a growing number are converging around a **cluster of priorities** related to numeracy, screening, intervention, materials, and research-aligned professional learning.

California provides a useful contrast. Rather than moving in the same direction as many of the states summarized above, the state revised its mathematics framework in ways widely read as more reform-oriented, placing greater emphasis on discovery learning, group work, and sociocultural responsiveness while de-emphasizing memorization and direct instruction. The framework drew sharp criticism from STEM professionals and parents who argued that it downplayed traditional content mastery. The contrast matters because it shows that the broader policy landscape is not uniform: although the dominant trend leans toward structured, intervention-focused policies, reform-oriented alternatives remain visible.

Whether these policies improve achievement will have to be judged over time. Alabama offers an early, but limited, signal. It was among the first states to adopt math policies emphasizing procedural fluency, early intervention, teacher coaching, and explicit instruction, and its 2024 fourth-grade NAEP math scores rose above pre-pandemic levels. That pattern is noteworthy, but it is far too early to infer that Science of Math-associated policies caused the improvement. The stronger conclusion, for now, is that early-adopting states warrant close study as more outcome data accumulate.

Another open question is what may be lost as states move in this direction. It remains to be seen whether a policy shift toward more traditional-leaning instruction will crowd out commitments to **equity and culturally responsive teaching**. In June 2025, NCTM's position statement on the "culture of teaching mathematics" called for greater attention to community and cultural knowledge and a move away from treating coursework as the sole gatekeeper to advanced mathematics. At the same time, Science of Math advocates have also acknowledged persistent inequities in mathematics achievement across lines of race, ethnicity, English learner status, socioeconomic status, and disability. In a rare **moment of agreement**, both emphasize the importance of fostering **equitable learning environments** by considering the unique assets, experiences, and needs of all students. What remains less clear is whether the current wave of state policy will integrate those equity commitments in meaningful ways or continue to emphasize structured instruction without the broader culturally responsive agenda more often associated with reform-oriented approaches.

INSIDE THE CLASSROOM: TARGETING INSTRUCTIONAL PRACTICES

The recent flurry of math bills clearly signals renewed interest in shaping the **instructional supports and practices** schools use to teach mathematics. As reflected in Appendix C, many recent state policies emphasize structured, evidence-based, and intervention-oriented approaches. These reforms do not map neatly onto the traditional-reform divide because they operate mainly through screening, intervention, materials, and instructional capacity rather than through explicit endorsement of a single pedagogy.

While this policy trend is certainly notable, it is still likely to leave many educators with **limited specificity** to guide day-to-day instruction. As our review of dichotomies highlighted, state policies can signal broad priorities around screening, materials, intervention, and professional learning without resolving the classroom-level questions that continue to divide the field. Significant disagreement remains over sequencing and prioritization, leaving teachers to reconcile opposing claims, with both sides citing research to support their positions.[116] Those tensions are also reflected in the guidance educators receive from prominent professional organizations, including the recent position statements discussed earlier in this guide. Is it really necessary to build students' conceptual understanding before practicing procedural fluency? If not, what exactly does it mean to teach arithmetic fluency and conceptual understanding in a mutually beneficial, complementary, and intertwined way?[117] Should explicit instruction be prioritized mainly for novice and struggling students? When is the best time to incorporate guided inquiry? And what are the most effective ways of combining inquiry-based and explicit instruction?

In theory, questions about sequencing or which practices are effective and for whom should be addressed through research. In practice, however, educators still encounter conflicting guidance about which instructional practices to emphasize in daily teaching. Rather than rehearse those disputes yet again, a more practical next step is to examine what the available classroom research suggests teachers are actually doing.

The answer is necessarily tentative. Even setting aside methodological differences among surveys, instructional logs, and direct observations, it remains difficult to assemble a comprehensive portrait of mathematics instruction at scale because most studies focus on particular practices, teacher samples, and grade bands. Still, taken together, studies of more than 5,300 mathematics teachers offer a useful but incomplete **snapshot of prevailing instructional patterns**.

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116. McNeil et al., "What the Science of Learning Teaches," 10-11.

117. National Mathematics Advisory Panel, "Final Report," 11, 19, 30

Across nearly a dozen studies over the last decade, the majority of teachers surveyed or observed were kindergarten teachers (56%),[118] followed by a roughly even split between elementary (18%)[119] and middle school teachers (22%),[120] with only a small sample of high school teachers (4%).[121] Approximately 70% of the studies focused on reform-oriented inquiry-based practices ("ambitious practices"),[122] while the remaining 30% focused on more traditional evidence-based practices, such as explicit instruction.[123] With those limitations in mind, the reviewed studies suggest that **conventional routines and some unsupported practices remain common** in many mathematics classrooms,[124] while some **reform-aligned and evidence-based practices appear less consistently implemented**.[125] That pattern should be read cautiously. The literature is uneven across grade spans, practice definitions, and study designs, and several frequently observed conventional routines, such as teacher-led explanation, are not equivalent to the systematic, explicit instruction examined in intervention research. Even so, the available evidence points to a meaningful **implementation gap** between the kinds of practices often recommended in principle and what occurs most consistently in classrooms.

Across a large national sample of kindergarten teachers, conventional practices such as the use of worksheets were widespread.[126] Teacher-led instruction and lectures also appeared to be common in studies of upper elementary, rural algebra, and middle school teachers.[127] Unsubstantiated practices likewise persisted; for example, 50% of rural algebra teachers

118. Gottfried, Fletcher, and Comstock, "Teaching Mathematics in Kindergarten," 110; Doabler et al., "Examining Teachers' Use of Evidence-Based Practices," 102.

119. Hill, Litke, and Lynch, "Learning Lessons From Instruction," 177; Kaufman, Stein, and Junker, "Factors Associated with Alignment," 342; Schweig, Kaufman, and Opfer, "Day by Day," 180.

120. Tekkumru-Kisa et al., "Teachers' Use of High-Leverage Teaching Practices," 9; Kraft and Hill, "Developing Ambitious Mathematics Instruction," 2383.

121. Hott et al., "Practitioner Perceptions of Algebra Strategy," 7.

122. See, for example, Gottfried, Fletcher, and Comstock, "Teaching Mathematics in Kindergarten," 103; Hill, Litke, and Lynch, "Learning Lessons From Instruction," 176; Kaufman, Stein, and Junker, "Factors Associated with Alignment," 340; Kraft and Hill, "Developing Ambitious Mathematics Instruction," 2378; Schweig, Kaufman, and Opfer, "Day by Day," 176; Tekkumru-Kisa et al., "Teachers' Use of High-Leverage Teaching Practices," 5.

123. See, for example, Doabler et al., "Examining Teachers' Use of Evidence-Based Practices," 99; Hott et al., "Practitioner Perceptions of Algebra Strategy," 4; Peltier et al., "Trends Come and Go," 217.

124. Gottfried, Fletcher, and Comstock, "Teaching Mathematics in Kindergarten," 119; Hill, Litke, and Lynch, "Learning Lessons From Instruction," 180; Hott et al., "Practitioner Perceptions of Algebra Strategy," 7; Peltier et al., "Trends Come and Go," 219.

125. Doabler et al., "Examining Teachers' Use of Evidence-Based Practices," 109; Hill, Litke, and Lynch, "Learning Lessons From Instruction," 182; Tekkumru-Kisa et al., "Teachers' Use of High-Leverage Teaching Practices," 14-16.

126. Gottfried, Fletcher, and Comstock, "Teaching Mathematics in Kindergarten," 122.

127. Hill, Litke, and Lynch, "Learning Lessons From Instruction," 11; Hott et al., "Practitioner Perceptions of Algebra Strategy," 7; Banilower et al., "Report of the 2018 NSSME+," 119.

and 70% of early childhood teachers reported routinely or frequently using methods based on "learning styles."[128] By contrast, reform-aligned and evidence-based practices appeared less common or less robustly implemented. In one study of middle school teachers, cognitively demanding tasks were a top priority on only about one-third of instructional days, and meaningful student discourse occurred, on average, only once a week or less.[129] Similarly, observations of upper elementary teachers found that although conceptually focused elements were present in 85% of lessons, they were rarely enacted with high quality.[130] Specific evidence-based interventions, such as the concrete-representation-abstract (CRA) sequence and schema-based instruction, also appeared underused, with more than half of rural algebra teachers reporting that they were unfamiliar with or did not use them.[131] It is important to note, however, that while conventional practices such as teacher-led lectures and worksheets appear common, these studies did not treat them as equivalent to systematic, explicit instruction.[132] Where explicit instruction and its components were examined directly, researchers found that its prevalence varied considerably across classrooms and that implementation was often partial or inconsistent.[133]

Since most teachers adjust their instructional practices to match students' current levels of performance, these findings are hardly surprising. When faced with a large number of low-performing students, teachers may hesitate to emphasize cognitively challenging tasks and reform-aligned practices that focus on student reasoning and problem-solving. Unfortunately, the contrasting emphasis on procedural fluency appears to be implemented through conventional or disproven practices, rather than evidence-based ones. Fortunately, a robust research literature exists that offers teachers a range of instructional practices effective for students with math difficulties and disabilities. In response to a position statement by the Council for Exceptional Children and NCTM on teaching students with disabilities, a group of over 30 researchers in special education and related fields, including a lead author for the Science of Math movement, provided seven **actionable, research-validated recommendations**, including (a) use systematic, explicit instruction; (b) use clear and concise mathematical language; (c) use multiple representations, including number lines; (d) develop fluency; (e) develop word-problem solving; (f) provide response opportunities, feedback, and practice;

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128. Hott et al., "Practitioner Perceptions of Algebra Strategy," 7; Peltier et al., "Trends Come and Go," 219.

129. Tekkumru-Kisa et al., "Teachers' Use of High-Leverage Teaching Practices," 14, 16.

130. Hill, Litke, and Lynch, "Learning Lessons From Instruction," 13-14.

131. Hott et al., "Practitioner Perceptions of Algebra Strategy," 8.

132. Peltier et al., "Trends Come and Go," 221; Doabler et al., "Examining Teachers' Use of Evidence-Based Practices," 100.

133. Doabler et al., "Examining Teachers' Use of Evidence-Based Practices," 109; Peltier et al., "Trends Come and Go," 221.

and (g) collect data to adapt instruction.[134] Given that these practices are effective for a variety of struggling students, we provide additional details in Appendix D.

A reasonable question, then, is whether instructional practices validated largely in special education research can be generalized beyond that population. While special education researchers naturally focus on students with disabilities, many of the interventions they study are also used to support **students with mathematics difficulties** who are considered at risk but have not been formally identified with a disability.[135] Explicit instruction is one example: it is a well-established evidence-based practice supported across a very large body of research involving students with disabilities as well as novice and struggling learners.[136] At the same time, the broader point is not that one practice alone resolves the field's disagreements, but that the scale of unfinished learning in mathematics underscores the urgency of drawing more consistently on practices with a strong research base. In that context, explicit instruction is best understood not merely as a "useful tool," but as one **important component of evidence-based math instruction**, especially for novice, struggling, and underprepared learners. The fact that many Science of Math advocates come from special education does not, by itself, diminish the relevance of the research they cite. At the same time, some scholars caution that mathematics research involving students with disabilities has often been shaped by narrower behavioral and medical traditions,[137] making it important to consider how broadly its findings generalize[138] and whether they sufficiently attend to equity, context, and students' mathematical agency.[139]

With a clearer, though still incomplete, sense of prevailing instructional patterns and the practices most consistently supported in the research base, the next question is where the field should go from here. Educators need **clearer guidance** on well-supported mathematics practices, which means stronger synthesis across disciplines, more careful translation of research into actionable recommendations, and more sustained support for implementation. Some of that work is best suited to national leadership, but much of it can begin locally through sharper practice guidance, stronger teacher preparation, and job-embedded professional learning.

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134. Powell et al., "The NCTM/CEC Position Statement," 2.

135. Powell et al., "The NCTM/CEC Position Statement," 3; Rojo et al., "A Meta-Analysis of Mathematics Interventions," 2; Nelson et al., "A Systematic Review of Research Syntheses," 20.

136. Powell et al., "The NCTM/CEC Position Statement," 13; Mancenido et al., "The Impact of Context on Evidence-Based Practices," 11, 13; McNeil et al., "What the Science of Learning Teaches Us," 30-31.

137. Lambert and Tan, "Does disability matter," 5, 19-20; Tan, Padilla, and Lambert, "A Critical Review," 873.

138. Lambert and Tan, "Does disability matter," 7.

139. Lambert and Tan, "Does disability matter," 7, 24, 27; Tan, Padilla, and Lambert, "A Critical Review," 891.

LOOKING AHEAD: STEPS TOWARD ENDING MATH'S "FOREVER WAR"

Building a Stronger Interdisciplinary Evidence Base

If the Math Wars have shown anything, it is that evidence alone does not settle disputes unless there is also broad agreement on how to interpret and apply it in practice. A constructive next step is therefore not to narrow the conversation, but to strengthen it through a **broader interdisciplinary synthesis**. Research on mathematics teaching and learning now spans mathematics education, special education, school psychology, cognitive science, developmental psychology, and the learning sciences. Bringing these strands into closer conversation would better reflect the complexity of mathematics learning and provide educators with guidance that is both more coherent and actionable. Proponents of the Science of Learning and Development (SoLD) make a similar argument, emphasizing that educational improvement depends on integrating insights across multiple fields and connecting them to well-vetted practices that support learning, development, and resilience.[140] They also emphasize that productive instructional practice includes both well-scaffolded instruction and meaningful opportunities for inquiry, feedback, and application.[141]

At the same time, not all forms of evidence answer the same questions equally well. Qualitative research can illuminate classroom processes, student experience, and the contexts in which instruction unfolds. But when state agencies, districts, or national organizations issue broad recommendations about which instructional practices are most effective, they also need evidence capable of identifying causal effects. That is why controlled experimental and quasi-experimental research remains critical for some kinds of claims, especially those that aim to guide large-scale policy. The challenge ahead is not to elevate one method above all others, but to build a more **coherent evidentiary base** in which different methods contribute what they are best suited to show, giving practitioners clearer guidance about what works, for whom, and under what conditions.

A Better Framework for Sequencing and Instructional Design

If the recurring debates in this guide are often less about whether a practice matters than about when, how, and for whom it is most useful, then the field also needs stronger instructional frameworks for sequencing and design.

140. Darling-Hammond et al., "Implications for Educational Practice," 97.

141. Ibid., 98-99.

Cognitive load theory (CLT) remains especially valuable here. CLT starts from a simple but consequential premise: novel information is processed through a limited working memory, and instruction is more effective when it manages that load well and supports the building of knowledge in long-term memory. It also highlights the importance of expertise reversal and guidance fading, showing why more explicit guidance tends to be especially important for novices learning complex new content. At the same time, more independent problem-solving becomes increasingly appropriate as knowledge grows. In Appendix E, we provide a list of instructional guidelines teachers can use to adapt their instruction based on CLT research.

That does not mean CLT should be treated as the only framework the field needs, nor that it resolves every dispute addressed in this guide. But it does offer a particularly useful lens for thinking about instructional sequencing, the design of examples and tasks, and the gradual release of support. Used well, it can help move the conversation beyond slogans such as “discovery versus direct instruction” and toward more precise judgments about **cognitive demand, prior knowledge, and the design of learning experiences**. Just as importantly, SoLD advocates remind us that effective instruction must also attend to motivation, relationships, formative assessment, and broader systems of support. The most productive path forward is therefore not to pit these perspectives against one another, but to ask how they can be brought into better alignment with each other.

Renewing National Guidance: A High-Level Strategy

The field would also benefit from renewed national guidance. The 2008 National Mathematics Advisory Panel remains one of the most important attempts to synthesize the research base for mathematics education and to clarify areas where longstanding debates had become unproductive. At this point, the evidence base is larger, the policy context is more urgent, and the disciplinary landscape broader. A new national mathematics advisory effort could revisit the earlier panel’s questions while incorporating nearly **two decades of new developments** in mathematics education, special education, cognitive psychology, developmental science, and the learning sciences. Its aim should not be to declare winners and losers in the Math Wars, but to produce clearer, more transparent guidance on what is known, what remains open to further inquiry, and where practitioners can implement confidently.

That work would be especially valuable if it were **bipartisan and broadly representative** across adjacent fields. One of the guide’s recurring themes is that the field has too often operated through parallel networks that generate incomplete guidance from within their own epistemic communities. A renewed advisory process would not eliminate disagreement, but it could reduce fragmentation and give states, districts, teacher educators, and curriculum leaders a more coherent reference point than they currently have.

Identifying Local Priorities: Ground-Level Tactics

Even without a new national panel, states and districts do not need to wait to strengthen mathematics instruction. Several concrete steps could improve coherence and classroom support without requiring leaders to resolve every outstanding dispute in the Math Wars. One useful starting point is a mathematics-specific **instructional audit** using brief walk-through tools, artifact reviews, and teacher surveys. Such an audit could examine the prevalence of low-demand or low-participation routines, the frequency of cognitively demanding tasks and substantive student discourse, and teachers' familiarity with high-leverage, evidence-based practices such as clear modeling, multiple representations, schema-based problem-solving, and structured opportunities for student response. The goal is not simply to measure activity, but to distinguish activity from mathematical learning and to identify gaps between intended and enacted instruction.

Districts can then translate those findings into clearer **practice guidance**. Rather than issuing broad endorsements of a single general practice, leaders could provide 'stop, start, and strengthen' guidance that reduces reliance on unsupported or low-value routines, clarifies priority practices, and specifies when more systematic, explicit teaching, structured discourse, and targeted supports are most appropriate, especially for novices, struggling learners, and students with mathematics difficulties. A district **mathematics playbook** can make that guidance more usable by defining key practices, standardizing mathematical language and routines across grade bands, and providing concrete examples, checklists, one-pagers, and short demonstration materials for teachers.

Districts can also bring high-leverage, evidence-based supports more fully into **Tier 1** rather than reserving them mainly for intervention settings. This is especially important for narrowing the persistent gap between general and special education approaches to mathematics instruction. Supports such as multiple representations, carefully scaffolded explicit modeling, schema-based problem-solving routines, and concrete-representational-abstract sequences should be more available in core instruction before students fall behind. Teachers also benefit from **clearer expectations** for active participation and mathematical talk, supported by frequent whole-class response opportunities, discussion protocols, and tasks that provide meaningful challenge with appropriate scaffolding. Ultimately, Tier 1 is where **equity commitments** are either realized or bypassed, depending on whether all students receive the structured support they need to access grade-level content and have meaningful opportunities to reason, discuss, and apply mathematics within core instruction, not only once difficulty has emerged.

Finally, these efforts are more likely to stick when they are embedded in regular **data cycles** and **job-embedded coaching**. Universal screening, recurring MTSS-style team meetings that document instructional adjustments, and non-evaluative coaching cycles focused on observation, rehearsal, modeling, and feedback can help schools move from broad aspirations to more consistent classroom enactment. Framed this way, near-term progress depends less on choosing between traditional or reform monoliths and more on helping teachers use both more intentionally, with clearer steps, stronger supports, and better implementation.

CONCLUSION

Even though the Math Wars have not come to an end (yet), this guide has tried to trace a path through them. Important differences remain regarding sequencing, evidence standards, and the goals of mathematics education. Yet, the current wave of state policy also reflects a renewed demand for clearer guidance on instruction and the evidence used to justify it. For state and district leaders navigating that landscape, the guide has aimed to do what Dewey said a good map does: not replace the journey, but make it more navigable.

Many of the recurring dichotomies examined here are not pure either/or choices, but they are not empty disagreements either. They often turn on real differences in instructional default, timing, and evidentiary judgment. Some of the most defensible decisions will therefore draw selectively from both traditions rather than aligning wholesale with either one.

Even so, several broad commitments recur across the debate: students deserve mathematics instruction that develops usable skill, meaningful understanding, and genuine access to success; teachers deserve clearer guidance about which practices are well supported, which remain contested, and where schools can act with confidence; and the field as a whole would benefit from less fragmentation and more usable synthesis. The task ahead is not to pretend the disagreements have disappeared, but to give educators better grounds for navigating them so that more students can experience mathematics not only as something to do correctly, but as something to understand and appreciate deeply.

REFERENCES

Achieve, Inc. Strong Standards: A Review of State Changes to the *Common Core State Standards in Mathematics*. Washington, DC: Achieve, Inc., 2017.

Alfieri, Louis, Patricia J. Brooks, Naomi J. Aldrich, and Harriet R. Tenenbaum. "Does Discovery-Based Instruction Enhance Learning?" *Journal of Educational Psychology* 103, no. 1 (2011): 1-18. https://doi.org/10.1037/a0021017.

Ashcraft, Mark H. "Math Anxiety: Personal, Educational, and Cognitive Consequences." *Current Directions in Psychological Science* 11, no. 5 (2002): 181-85. https://doi.org/10.1111/1467-8721.00196.

Ashcraft, Mark H., and Jennifer A. Krause. "Working Memory, Math Performance, and Math Anxiety." *Psychonomic Bulletin & Review* 14 (2007): 243-48. https://doi.org/10.3758/BF03194059.

Askey, Richard. "Good Intentions Are Not Enough." In *The Great Curriculum Debate: How Should We Teach Reading and Math?*, edited by Tom Loveless, 163-183. Washington, D.C.: Brookings Institution Press, 2001.

Association of Mathematics Teacher Educators (AMTE) Writing Team. *Evidence-Based Math Instruction*. Charlotte, NC: Information Age Publishing, 2025.

Banilower, Eric R., P. Sean Smith, Kathryn A. Malzahn, Courtney L. Plumley, Evelyn M. Gordon, and Meredith L. Hayes. *Report of the 2018 NSSME+*. Chapel Hill, NC: Horizon Research, Inc., 2018.

Barshay, Jill. "PROOF POINTS: How a Debate Over the Science of Math Could Reignite the Math Wars." *The Hechinger Report*, May 8, 2023. https://hechingerreport.org/proof-points-how-a-debate-over-the-science-of-math-could-reignite-the-math-wars/.

Beilock, Sian L. "Math Performance in Stressful Situations." *Current Directions in Psychological Science* 17, no. 6 (2008): 339-343. https://doi.org/10.1111/j.1467-8721.2008.00602.x.

Boaler, Jo. "Research Suggests Timed Tests Cause Math Anxiety." *Teaching Children Mathematics* 20, no. 8 (2014): 469-74.

Bolyard, Johnna, Reagan Curtis, and Darran Cairns. "Learning to Struggle: Supporting Middle-grade Teachers' Understanding of Productive Struggle in STEM Teaching and Learning." *Canadian Journal of Science, Mathematics and Technology Education* 23, no. 4 (2023): 687-702. https://doi.org/10.1007/s42330-023-00302-0

Burrill, Gail. “Mathematics Education: The Future and the Past.” In *The Great Curriculum Debate: How Should We Teach Reading and Math?*, edited by Tom Loveless, 25-41. Washington, D.C.: Brookings Institution Press, 2001.

Carpenter, Thomas P., Megan L. Franke, Victoria R. Jacobs, Elizabeth Fennema, and Susan B. Empson. “A Longitudinal Study of Invention and Understanding in Children’s Multidigit Addition and Subtraction.” *Journal for Research in Mathematics Education* 29, no. 1 (1998): 3-20. https://doi.org/10.5951/jresematheduc.29.1.0003.

Caviola, Sara, Emma Carey, Irene C. Mammarella, and Dénes Szűcs. “Stress, Time Pressure, Strategy Selection and Math Anxiety in Mathematics: A Review of the Literature.” *Frontiers in Psychology* 8 (2017): 1488. https://doi.org/10.3389/fpsyg.2017.01488.

Chen, Y.-C., M. Jordan, J. Park, and E. Starrett. “Navigating Student Uncertainty for Productive Struggle.” *Science Education* 108 (2024): 1099-1133. https://doi.org/10.1002/sce.21864.

Clark, Richard E., Paul A. Kirschner, and John Sweller. “Putting Students on the Path to Learning: The Case for Fully Guided Instruction.” *American Educator* 36 (2012): 5-11.

Clark, Ruth Colvin, Frank Nguyen, and John Sweller. *Efficiency in Learning: Evidence-Based Guidelines to Manage Cognitive Load.* San Francisco: Pfeiffer, 2006.

Codding, Robin S., Christopher Peltier, and Jessica Campbell. “Introducing the Science of Math.” *Teaching Exceptional Children* 56, no. 1 (2023): 6-11. https://doi.org/10.1177/00400599221121721.

Cohen, Julie, Nathan Jones, and Laura Gibbons. “The Missing Middle? General and Special Educators’ Views of Effective Mathematics Instruction.” *AERA Open* 11, no. 1 (2025): 1-14. https://doi.org/10.1177/23328584251344901.

Common Core State Standards Initiative. *Common Core State Standards for Mathematics*. Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers, 2010. http://www.corestandards.org/Math/.

Darling-Hammond, Linda, Lisa Flook, Channa Cook-Harvey, Brigid Barron, and David Osher. “Implications for Educational Practice of the Science of Learning and Development.” *Applied Developmental Science* 24, no. 2 (2020): 97-140. https://doi.org/10.1080/10888691.2018.1537791 de Jong, Ton, Ard W. Lazonder, Clark A. Chinn, Frank Fischer, Janice Gobert, Cindy E. Hmelo-Silver, Ken R. Koedinger, et al. “Beyond Inquiry or Direct Instruction: Pressing Issues for Designing Impactful Science Learning Opportunities.” *Educational Research Review* 44 (2024): 100623.

de Jong, Ton, Ard W. Lazonder, Clark A. Chinn, Frank Fischer, Janice Gobert, Cindy E. Hmelo-Silver, Ken R. Koedinger, et al. “Let’s Talk Evidence—The Case for Combining Inquiry-Based and Direct Instruction.” *Educational Research Review* 39 (2023): 100536. https://doi.org/10.1016/j.edurev.2023.100536

Delazer, Margarete, and Thomas Benke. “Arithmetic Facts without Meaning.” *Cortex* 33, no. 4 (1997): 697-710. https://doi.org/10.1016/S0010-9452(08)70727-5.

Dewey, John. *The Child and the Curriculum*. Chicago: University of Chicago Press, 1902.

Doabler, Christian T., Nancy J. Nelson, Derek B. Kosty, Hank Fien, Scott K. Baker, Keith Smolkowski, and Ben Clarke. “Examining Teachers’ Use of Evidence-Based Practices During Core Mathematics Instruction.” *Assessment for Effective Intervention* 39, no. 2 (2014): 99-111. https://doi.org/10.1177/1534508413511848.

Fischer, Jean-Paul, Bruno Vilette, Sophie Joffredo-Lebrun, Mireille Morellato, Céline Le Normand, Calliste Scheibling-Seve, and Jean-François Richard. “Should We Continue to Teach Standard Written Algorithms for the Arithmetical Operations? The Example of Subtraction.” *Educational Studies in Mathematics* 101, no. 1 (2019): 105-121. https://doi.org/10.1007/s10649-019-09884-9.

Furtak, Erin Marie, Tina Seidel, Heidi Iverson, and Derek C. Briggs. “Experimental and Quasi-Experimental Studies of Inquiry-Based Science Teaching: A Meta-Analysis.” *Review of Educational Research* 82, no. 3 (2012): 300-329.

Fuson, Karen C., Mindy Kalchman, and John D. Bransford. “Mathematical Understanding: An Introduction.” In *How Students Learn: History, Mathematics, and Science in the Classroom*, edited by M. Suzanne Donovan and John D. Bransford, 217-256. Washington, DC: National Academies Press, 2005.

Garelick, Barry, and Jason Zimba. “The Problem of Instructional Time: A Conversation on Common Core.” *Brookings* (blog), October 14, 2015.

Gottfried, Michael, Tina Fletcher, and Meghan Comstock. "Teaching Mathematics in Kindergarten: How Does Instruction Differ by Classroom Ability?" *Teachers College Record* 125, no. 10 (2023): 102-130. https://doi.org/10.1177/01614681231223343

Hill, Heather C., Erica Litke, and Kathleen Lynch. "Learning Lessons From Instruction: Descriptive Results from an Observational Study of Urban Math Classrooms." *Teachers College Record* 120, no. 12 (2018): 1-46.

Hott, Brittany L., Rebecca-Anne Dibbs, Gil Naizer, Lesli Raymond, Campbell C. Reid, and Amelia Martin. "Practitioner Perceptions of Algebra Strategy and Intervention Use to Support Students With Mathematics Difficulty or Disability in Rural Texas." *Rural Special Education Quarterly* 38, no. 1 (2019): 3-14. https://doi.org/10.1177/8756870518795494

Kamii, Constance, and Ann Dominick. "To Teach or Not to Teach Algorithms." *Journal of Mathematical Behavior* 16 (1997): 51-61.

Kapur, Manu. "Productive Failure in Learning Math." *Cognitive Science* 38, no. 5 (2014): 1008-22.

Kaufman, Julia Heath, Mary Kay Stein, and Brian Junker. "Factors Associated with Alignment Between Teacher Survey Reports and Classroom Observation Ratings of Mathematics Instruction." *The Elementary School Journal* 116, no. 3 (2016): 340-364.

Khan, Faheem, Aqsa Ahmad, Memoona Gul, Shakeel Hussain, and Sobia Yousaf. "Effect of Scaffolding Teaching Method on Students' Academic Achievement in Mathematics." *Journal of Social Sciences and Management Studies* 1, no. 2 (2022): 48-51. https://doi.org/10.56556/jssms.v1i2.81

Kirschner, Paul A., John Sweller, and Richard E. Clark. "Why Minimal Guidance during Instruction Does Not Work." *Educational Psychologist* 41, no. 2 (2006): 75-86. https://doi.org/10.1207/s15326985ep4102_1.

Kraft, Matthew A., and Heather C. Hill. "Developing Ambitious Mathematics Instruction Through Web-Based Coaching: A Randomized Field Trial." *American Educational Research Journal* 57, no. 6 (2020): 2378-2414. https://doi.org/10.3102/0002831220916840

Lambert, Rachel, and Paulo Tan. "Does Disability Matter in Mathematics Educational Research? A Critical Comparison of Research on Students with and without Disabilities." *Mathematics Education Research Journal* 32, no. 1 (2019): 5-35. https://doi.org/10.1007/s13394-019-00299-6.

Lazonder, Ard W., and Ruth Harmsen. "Meta-Analysis of Inquiry-Based Learning: Effects of Guidance." *Review of Educational Research* 86, no. 4 (2016): 681-718.

Loveless, Tom. "A Tale of Two Math Reforms: The Politics of the New Math and the NCTM Standards." In *The Great Curriculum Debate: How Should We Teach Reading and Math?*, edited by Tom Loveless, 184-209. Washington, D.C.: Brookings Institution Press, 2001.

Maki, Katharine E., Andrew F. Zaslofsky, Robin Codding, and Brittany Woods. "Math Anxiety in Elementary Students." *Journal of School Psychology* 106 (2024): 101316. https://doi.org/10.1016/j.jsp.2024.101316.

Mancenido, Zid, K. Gonsalkorale, N. Flynn, and J. Brosnan. *The Impact of Context on Evidence-Based Practices: A Rapid Literature Scan on Formative Assessment, Explicit Instruction and Mastery Learning*. Melbourne: Australian Education Research Organisation, 2024. https://www.edresearch.edu.au/research/research-reports/impact-context-evidence-based-practices-rapid-literature-scan.

Mayer, Richard E. "Should There Be a Three-Strikes Rule Against Pure Discovery Learning? The Case for Guided Methods of Instruction." *American Psychologist* 59, no. 1 (2004): 14-19. https://doi.org/10.1037/0003-066X.59.1.14.

McNeil, Nicole M., Nancy C. Jordan, Alexandria A. Viegut, and Daniel Ansari. "What the Science of Learning Teaches Us About Arithmetic Fluency." *Psychological Science in the Public Interest* 26, no. 1 (2025): 10-57. https://doi.org/10.1177/15291006241287726

Merlo, Siobhan. *The Science of Maths and How to Apply It*. Analysis Paper 71. Sydney: Centre for Independent Studies, 2024.

Murdoch, Dani, A. R. English, A. Hintz, and K. Tyson. "Feeling Heard: Inclusive Education, Transformative Learning, and Productive Struggle." *Educational Theory* 70, no. 5 (2020): 653-679. https://doi.org/10.1111/edth.12449.

National Council of Supervisors of Mathematics. *Strengthening Research-Informed Decision Making for Mathematics Education: Our Position*. Position statement, 2025. https://www.mathedleadership.org/wp-content/uploads/2025/12/Position-Paper-2025-Strengthening-Research-informed-Decision-REV12-25.pdf

National Council of Teachers of Mathematics. *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM, 2014.

National Mathematics Advisory Panel. *Foundations for Success: The Final Report of the National Mathematics Advisory Panel*. Washington, DC: U.S. Department of Education, 2008.

National Research Council. *Adding It Up: Helping Children Learn Mathematics*. Edited by Jeremy Kilpatrick, Jane Swafford, and Bradford Findell. Washington, DC: National Academies Press, 2001. https://doi.org/10.17226/9822.

Nelson, Gena, Angela Crawford, Jessica Hunt, Soyoung Park, Emily Leckie, Alex Duarte, Tasia Brafford, Mary Ramos-Duke, and Kary Zarate. "A Systematic Review of Research Syntheses on Students with Mathematics Learning Disabilities and Difficulties." *Learning Disabilities Research & Practice* 37, no. 1 (2022): 18-36. https://doi.org/10.1111/ldrp.12272.

Norton, Stephen. "The Use of Alternative Algorithms in Whole Number Computation." *International Journal for Mathematics Teaching and Learning* (2012): 2-16.

Nwoke, B. I. "Impact of Instructional Scaffolding Approach on Students' Mathematics Achievement." *Electronic Journal of Education, Social Economics and Technology* 1, no. 1 (2020): 23-31.

Osana, Helena P., Emmanuelle Adrien, and Nathalie Duponsel. "Effects of Instructional Guidance and Sequencing of Manipulatives and Written Symbols on Second Graders' Numeration Knowledge." *Education Sciences* 7, no. 52 (2017).

Pedersen, Ida Friestad, and Per Øystein Haavold. "Students' Mathematical Beliefs and Motivation." *International Journal of Mathematical Education in Science and Technology* 54, no. 8 (2023): 1649-1663. https://doi.org/10.1080/0020739X.2023.2189171.

Peltier, Corey, Tiffany K. Peltier, Brittany L. Hott, Andrew Heuer, and Taylor Werthen. "'Trends Come and Go': Early Childhood Rural Special Education Teachers' Use of Reported Practices During Mathematics Instruction." *Rural Special Education Quarterly* 40, no. 4 (2021): 214-225. https://doi.org/10.1177/87568705211027981

Popham, Michelle, Simone Adams, and Janie Hodge. "Self-Regulated Strategy Development to Teach Mathematics Problem Solving." *Intervention in School and Clinic* 55, no. 3 (2020): 154-61. https://doi.org/10.1177/1053451219842197

Powell, Sarah R., Emily C. Bouck, Marah Sutherland, Ben Clarke, Tessa L. Arsenault, and Shaqwana Freeman-Green. "Essential Components of Math Instruction." *TEACHING Exceptional Children* 56, no. 1 (2023): 14-24.

Powell, Sarah R., Emily M. Hughes, and Christopher Peltier. *Myths That Undermine Maths Teaching*. Analysis Paper 38. Centre for Independent Studies, 2022.

Powell, Sarah R., Marcia A. Barnes, Jason Root, et al. "The NCTM/CEC Position Statement on Teaching Mathematics to Students with Disabilities: A Review of the Evidence." *Research in Special Education* 2 (2025): 1-37. https://doi.org/10.25894/rise.2796.

Ramirez, Gerardo, Elizabeth A. Gunderson, Susan C. Levine, and Sian L. Beilock. "Math Anxiety, Working Memory, and Math Achievement in Early Elementary School." *Journal of Cognition and Development* 14, no. 2 (2013): 187-202.

Rittle-Johnson, Bethany, Michael Schneider, and Jon R. Star. "Not a One-Way Street." *Educational Psychology Review* 27 (2015): 587-97.

Rojo, Megan, Jenna Gersib, Sarah R. Powell, Zhina Shen, Sarah G. King, Syeda Sharjina Akther, Tessa L. Arsenault, Samantha E. Bos, Danielle O. Lariviere, and Xin Lin. "A Meta-Analysis of Mathematics Interventions." *Educational Psychology Review* 36, no. 9 (2024). https://doi.org/10.1007/s10648-023-09843-0.

Salazar, Christian Laro. "Influence of Productive Struggle in Mathematics to the 21st Century Learners." *Docens Series in Education* 3 (2022): 71-92. https://doi.org/10.20319/dv3.7192.

Schweig, Jonathan D., Julia H. Kaufman, and V. Darleen Opfer. "Day by Day: Investigating Variation in Elementary Mathematics Instruction That Supports the Common Core." *Educational Researcher* 49, no. 3 (2020): 176-187. https://doi.org/10.3102/0013189X20909812.

Sisk, Victoria F., Alex P. Burgoyne, Jing Sun, John L. Butler, and Brooke N. Macnamara. "To What Extent and under Which Circumstances Are Growth Mind-Sets Important to Academic Achievement?" *Psychological Science* 29, no. 4 (2018): 549-71.

Son, Ji-Won. "Moving beyond a Traditional Algorithm in Whole Number Subtraction: Preservice Teachers' Responses to a Student's Invented Strategy." *Educational Studies in Mathematics* 93 (2016): 105-29. https://doi.org/10.1007/s10649-016-9693-8.

Stamper, Chris. "Dad's Rant About Common Core Math Problem Goes Viral." *Time*, March 25, 2014.

Sweller, John, Jeroen J. G. van Merriënboer, and Fred Paas. “Cognitive Architecture and Instructional Design: 20 Years Later.” *Educational Psychology Review* 31, no. 2 (2019): 261-292. https://doi.org/10.1007/s10648-019-09465-5.

Sweller, John, L. Zhang, Greg Ashman, William Cobern, and Paul A. Kirschner. “Response to de Jong et al.’s (2023) Paper.” *Educational Research Review* 42 (2024): 100584. https://doi.org/10.1016/j.edurev.2023.100584.

Tan, Paulo, Alexis Padilla, and Rachel Lambert. “A Critical Review of Educator and Disability Research in Mathematics Education: A Decade of Deficit Thinking.” *Review of Educational Research* 92, no. 5 (2022): 873-915.

Tekkumru-Kisa, Miray, Jonathan Schweig, Julia H. Kaufman, Elizabeth D. Steiner, Allyson D. Gittens, and Pierrce Holmes. *Teachers’ Use of High-Leverage Teaching Practices in Mathematics Classrooms*. RAND Education and Labor Working Paper WR-A2836-1. Santa Monica, CA: RAND Corporation, 2025.

Torbeyns, Joke, and Lieven Verschaffel. “Mental Computation or Standard Algorithm?” *European Journal of Psychology of Education* 31, no. 2 (2016): 99-116.

Tsui, Joanne M., and Michèle M. M. Mazzocco. “Effects of Math Anxiety and Perfectionism on Timed versus Untimed Math Testing in Mathematically Gifted Sixth Graders.” *Roeper Review* 29, no. 2 (2007): 132-39.

van Merriënboer, Jeroen J. G., and Dyonne M. A. Sluijsmans. “Toward a Synthesis of Cognitive Load Theory.” *Educational Psychology Review* 21, no. 1 (2009): 55-66.

Wang, Zhe, Sarah L. Lukowski, Sara A. Hart, Ian M. Lyons, Lee A. Thompson, Michelle M. Mazzocco, Robert Plomin, and Stephen A. Petrill. “Is Math Anxiety Always Bad for Math Learning?” *Psychological Science* 26, no. 12 (2015): 1863-71. https://doi.org/10.1177/0956797615602471.

Warshauer, Hiroko K. “Productive Struggle in Middle School Mathematics Classrooms.” *Journal of Mathematics Teacher Education* 18, no. 4 (2015): 375-400.

Weingarden, Merav. “Exploring Pre-Service Mathematics Teachers’ Perspectives on Balancing Student Struggle and Concept Attention.” *Teaching and Teacher Education* 165 (2025): 105143. https://doi.org/10.1016/j.tate.2025.105143.

Zhang, Lei, Paul A. Kirschner, William W. Cobern, and John Sweller. “There Is an Evidence Crisis in Science Educational Policy.” *Educational Psychology Review* 34 (2022): 1157-76. https://doi.org/10.1007/s10648-021-09646-1.

APPENDIX A

Note: A glossary of key terms for navigating the Math Wars, as used in this guide.

Term	Definition
Instructional Approaches	
Explicit instruction *(systematic, explicit instruction)*	A structured, systematic approach in which the teacher clearly models concepts, procedures, and problem-solving processes; provides guided practice, frequent opportunities to respond, and corrective feedback; and gradually fades support toward independent mastery. As used in this guide, explicit instruction refers to this evidence-based practice, not simply any instance of a teacher explaining content.
Direct instruction	A teacher-led instructional approach characterized by clear goals, careful sequencing, active monitoring of student performance, high rates of accurate responding, and immediate academically focused feedback. Distinct from branded Direct Instruction (capitalized), which refers to the scripted Engelmann-Becker curriculum. In this guide, however, direct instruction is sometimes also used more generically to refer to teacher-led instruction.
Inquiry-based instruction	An overarching, student-centered approach in which students explore worthwhile mathematical problems, generate and test strategies or conjectures, justify their reasoning, and communicate their mathematical thinking, often through collaborative work on authentic tasks. This is the broad umbrella term for investigative learning; guided inquiry and discovery learning describe specific variations along a continuum of teacher guidance. As used in this guide, inquiry-based instruction does not imply the absence of teacher involvement.
Guided inquiry	A form of inquiry-based learning in which students investigate meaningful problems under deliberate teacher guidance. Teachers provide structured tasks, prompts, scaffolds, questioning, and feedback to reduce unnecessary cognitive load while preserving authentic sensemaking and problem solving. Guided inquiry is therefore distinct from pure discovery because teacher support is calibrated throughout the learning process.
Discovery learning *(unguided or minimally guided discovery)*	An approach in which learners are expected to discover or construct essential ideas largely on their own, with little or no direct instructional guidance on the concepts or procedures to be learned. In this guide, criticisms of “minimal guidance” refer to this unguided form, not to guided inquiry or other structured problem-based approaches.

Note: These terms are contested and sometimes used inconsistently across research, policy, and professional debates; the definitions reflect their use in this guide.

APPENDIX B

Note: Post-pandemic instructional priorities commonly associated with the Science of Math.

Priority	Description
Foundational numeracy focus (K-5)	Emphasis on early number sense, arithmetic, and core computational skills as a primary policy target.
Universal screening in mathematics	Required early numeracy/mathematics screeners and regular progress monitoring to identify students at risk.
Data-based decision making	Use of assessment data to place students, adjust instruction, trigger interventions, or identify schools for additional support.
Systematic, explicit instruction	Policies that call for instruction that is unambiguous, structured, sequenced, and scaffolded (often named as "explicit instruction," "systematic instruction," or similar language).
High-quality instructional materials	Adoption or approval of math curricula and programs based on research evidence or vetted by a state task force/office.
Targeted intervention for struggling students (i.e., multi-tiered support systems or MTSS)	Requirements for tiered supports, intensive intervention blocks, or specific intervention programs for students below benchmark.
Professional learning aligned to math education research	Required or funded PD focused on evidence-based math instruction, explicit instruction, intervention, or use of data.

APPENDIX C

Note: State-level math policy detail

State & Year	Policy Name & Focus	Key Provisions	Themes Reflected
ALABAMA (2022)	**Numeracy Act (K-5 foundational skills)**	Establishes statewide K-5 mathematics improvement framework; creates Office of Mathematics Improvement and Elementary Mathematics Task Force; requires universal early numeracy screeners and progress monitoring; mandates use of state-approved, evidence-based core curricula and intervention programs; provides K-5 math coaches, targeted support for low-performing schools, and tiered intervention requirements; includes reporting and accountability provisions tied to math proficiency.	**All 7 themes reflected**
NEW MEXICO (2022)	**"Math is Me" Initiative and Tutoring Corps (K-8 interventions preparing for algebra)**	Statewide initiative to strengthen math identity and engagement; establishes a tutoring corps providing targeted K-8 math support, with structured dosage, small group ratios, and use of high-quality instructional materials; tutoring is designed to close gaps and prepare students for algebra readiness.	**5 themes reflected** • foundational numeracy focus • data-based decision making • evidence-based instructional materials • targeted intervention • professional learning aligned to math ed research
WEST VIRGINIA (2023)	**Third Grade Success Act (K-3 math/literacy)**	Primarily a K-3 literacy act with parallel provisions for mathematics; requires universal early-grade screening in math and reading; mandates data-based identification of students needing support; requires evidence-based intervention for students below benchmark; and provides professional learning for teachers and interventionists in early numeracy practices.	**5 themes reflected** • foundational numeracy focus • universal screening • data-based decision making • targeted intervention • professional learning aligned to math ed research

State & Year	Policy Name & Focus	Key Provisions	Themes Reflected
ARKANSAS (2023)	**LEARNS Act (3-8 interventions)**	Broad K-12 reform package with a math-specific focus on grades 3-8; requires districts to provide high-dosage tutoring for students below proficiency; mandates adoption of high-quality instructional materials; requires use of assessment data to identify students for intervention and to monitor progress; funds professional learning for teachers and tutors; and includes accountability provisions for schools with persistently low math performance.	**4 themes reflected** • foundational numeracy focus • data-based decision making • high-quality, evidence-based instructional materials • targeted intervention
FLORIDA (2023, 2025)	**HB 7039 (K-4 supports & dyscalculia)** **F.S. 1008.25 (Early learning)**	Establishes K-4 screening and intervention requirements for mathematics difficulties, including dyscalculia; mandates universal screening for characteristics of dyscalculia; requires evidence-based, systematic intervention for students identified as at risk; requires districts to use evidence-based instructional materials; and provides professional learning for teachers on identifying and supporting students with dyscalculia.	**All 7 themes reflected**
COLORADO (2023)	**HB 23-1231 (Evidence-Informed PD & grants)**	Establishes a statewide grant program to support districts in providing evidence-informed professional development in mathematics; funds training aligned to research-supported instructional practices; and directs the Colorado Department of Education to support districts in implementing high-quality math instruction through PD and technical assistance.	**5 themes reflected** • foundational numeracy focus • data-based decision making • high-quality, evidence-based instructional materials • targeted intervention • professional learning aligned to math ed research
LOUISIANA (2023)	**Act 260 (Teacher PD - 50 hours)**	Requires K-5 teachers to complete 50 hours of professional development in mathematics focused on evidence-based instructional practices; PD is designed to strengthen teachers' implementation of high-quality math instruction and research-aligned materials.	**All 7 themes reflected**

State & Year	Policy Name & Focus	Key Provisions	Themes Reflected
TEXAS (2023, 2025)	**Texas SB 2124 (Middle School Advanced Math Enrollment) HB 2 and 8**	Establishes automatic enrollment into advanced middle-school math courses for students who meet objective academic criteria; requires districts to use assessment and performance data to determine eligibility; and aims to expand equitable access to advanced math pathways by reducing gatekeeping and inconsistent placement practices.	**All 7 themes reflected**
NEVADA (2023; renewed 2025)	**AB 383 (High-dosage tutoring)**	Establishes and extends high-dosage tutoring in mathematics; requires districts to identify students for tutoring based on assessment data; mandates use of high-quality instructional materials; and defines tutoring dosage through required frequency, duration, and group size.	**3 themes reflected** • data-based decision making • high-quality, evidence-based instructional materials • targeted intervention
MISSISSIPPI (2023; 2025)	**Mathematics Proficiency and Intervention Act (Early intervention)**	Establishes statewide early mathematics screening and intervention requirements; mandates use of state-approved math screeners; requires evidence-based, systematic instructional practices; mandates adoption of high-quality core and intervention materials; requires targeted intervention for students below benchmark; and provides professional learning for teachers in early numeracy and intervention practices.	**5 themes reflected** • foundational numeracy focus • universal screening • data-based decision making • high-quality, evidence-based instructional materials • targeted intervention
KENTUCKY (2024)	**Numeracy Counts Act (Comprehensive K-12)**	Comprehensive K-12 mathematics improvement law; establishes statewide early numeracy screening; mandates adoption of state-approved, evidence-based math curricula and intervention programs; requires explicit, systematic instructional practices; defines expectations for intervention dosage; provides statewide professional learning; and creates state-level structures to support implementation and monitor progress.	**All 7 themes reflected**
TENNESSEE (2024)	**SB 1712 (Math PD & Analysis)**	Requires statewide analysis of mathematics instruction and student outcomes; directs the state to identify gaps and develop recommendations; and provides for professional development aligned to evidence-based mathematics instructional practices.	**2 themes reflected** • explicit, systematic instruction • professional learning aligned to math ed research

State & Year	Policy Name & Focus	Key Provisions	Themes Reflected
WASHINGTON D.C. (2024)	**Math Task Force, DC Math Hub (Post-pandemic recovery)**	Establishes a Math Task Force to analyze student performance and recommend improvements; creates the DC Math Hub to provide research-aligned resources, professional learning, and implementation supports; focuses on post-pandemic math recovery and system-level capacity building.	**3 themes reflected** • high-quality, evidence-based instructional materials • professional learning aligned to math ed research • data-based decision making
INDIANA (2025)	**Indiana House Enrolled Act 1634 (K-8 foundational skills)**	Establishes statewide K-8 mathematics screening and intervention requirements; mandates use of state-approved math screeners; requires adoption of evidence-based core and intervention materials; provides targeted intervention for students below benchmark; and supports professional learning in early numeracy and intervention practices.	**6 themes reflected** • foundational numeracy focus • universal screening • data-based decision making • high-quality, evidence-based instructional materials • professional learning aligned to math ed research • targeted intervention
IOWA (2025)	**Math Counts Act (K-12 math re-form)**	Comprehensive K-12 mathematics reform law; establishes statewide early numeracy screening; mandates adoption of state-approved, evidence-based math curricula and intervention programs; requires explicit, systematic instructional practices; provides targeted intervention for students below benchmark; supports statewide professional learning; and creates state-level structures to guide implementation and monitor progress.	**All 7 themes reflected**
MONTANA (2025)	**HB 573 (Transformational learning**	Establishes statewide early mathematics screening and intervention requirements; mandates use of state-approved math screeners; requires adoption of evidence-based core and intervention materials; provides targeted intervention for students below benchmark; and supports professional learning in early numeracy and intervention practices.	**6 themes reflected** • foundational numeracy focus • universal screening • data-based decision making • high-quality, evidence-based instructional materials • targeted intervention • professional learning aligned to math ed researchn

State & Year	Policy Name & Focus	Key Provisions	Themes Reflected
OKLAHOMA (2025)	**Oklahoma Math Achievement and Proficiency Act (Early identification and screening)**	Establishes statewide early mathematics screening and intervention requirements; mandates use of state-approved math screeners; requires adoption of evidence-based core and intervention materials; provides targeted intervention for students below benchmark; and supports professional learning in early numeracy and evidence-based math instruction.	**All 7 themes reflected**
VIRGINIA (2025)	**22.1-207.9 — Advanced or Accelerated Mathematics Opportunities (Grades 5-8)**	Requires school divisions to ensure that students in grades 5-8 have access to advanced or accelerated mathematics pathways; mandates that eligibility be based on objective academic criteria, including performance on state and local assessments; directs divisions to provide multiple entry points into advanced coursework to expand access and reduce inconsistent placement practices; requires transparent communication with families about available pathways and placement criteria; and aims to increase equitable participation in advanced math opportunities prior to Algebra I.	**3 themes reflected** • data-based decision making • high-quality, evidence-based instructional materials • targeted intervention
MARYLAND (2025)	**Math Policy A: Statewide Mathematics Instruction and Intervention Framework (K-8 foundational skills & system capacity)**	Establishes a statewide mathematics improvement framework focused on K-8 instruction and early numeracy; requires districts to administer state-approved universal screeners in mathematics and use data to identify students needing additional support; mandates adoption of evidence-based core curricula and intervention programs aligned with research on foundational skills; directs districts to provide explicit, systematic instruction and targeted intervention for students below benchmark; requires professional learning for teachers and interventionists in research-aligned mathematics practices; and creates state-level structures to support implementation, monitor progress, and report on student outcomes.	**6 themes reflected** • foundational numeracy focus • universal screening • data-based decision making • high-quality, evidence-based instructional materials • targeted intervention • professional learning aligned to math ed research

APPENDIX D

The foundational practice recommended for struggling students and those with disabilities is **systematic, explicit instruction**, which involves designing instruction sequentially based on developmental theories, co-developing conceptual and procedural knowledge, and ensuring sufficient retrieval practice complemented by corrective feedback. This approach is favored because minimal guidance is less effective and efficient for novice learners dealing with complex information. Furthermore, teachers should use **clear and concise mathematical language**, giving explicit attention to math vocabulary, which is crucial for participation in learning and has a significant relationship with math performance. It is also recommended to use **multiple representations**, leveraging the strong support for the Concrete-Semiconcrete-Abstract (CSA) approach, and specifically incorporating number lines, as they are versatile visual models effective for improving rational number understanding and enhancing abstract conceptual understanding. Students need to develop **fluency** (accuracy, efficiency, and flexibility) across all mathematics content areas, which requires more productive practice opportunities than students without difficulties, often achieved through distributing practice and incorporating components like goal setting and self-graphing. To address application skills, instruction must explicitly develop **word-problem solving** through strategies such as systematic, explicit instruction paired with schema instruction (classifying problems by common types) and metacognitive strategies (e.g., teaching students to read, plan, solve, and check). These teaching methods should integrate the practice of providing ample **response opportunities, feedback, and practice** throughout instruction (not just during independent work) because frequent opportunities to respond positively impact learning outcomes. Finally, teachers must **collect data and adapt instruction** using a framework like Data-Based Individualization (DBI) to accurately assess targeted skills, identify error patterns through ongoing formative assessment, and individualize instructional decisions for students with intensive academic needs.

APPENDIX E

Adapted from Clark et al. (2006), we provide a list of **29 instructional guidelines** organized around established CLT effects. Please refer to the original source for additional information.

Use Visuals and Audio Narration to Exploit Working Memory Resources

1. Use diagrams to optimize performance on tasks requiring spatial manipulations.
   a. Diagrams permit faster processing because all elements can be viewed simultaneously (as opposed to text, which requires serial processing).
2. Use diagrams to promote learning of rules involving spatial relationships.
   a. Spatial relations can be readily ascertained via holistic processing, avoiding lengthy text descriptions.
3. Use diagrams to help learners build a deeper understanding.
   a. Allow for dual encoding (by providing learners multiple opportunities to encode information).
4. Explain diagrams with words presented in audio narration.
   a. Complex content, visuals, or text should be supported by audio narration to utilize the modality effect.

Focus Attention and Avoid Split Attention

5. Use cues and signals to focus attention on important visual and textual content.
   a. For complex content, focus the learner's attention on critical information by using cues and signals (e.g., bolding, highlighting, arrows, circles).
6. Integrate explanatory text close to related visuals on pages and screens.
7. Integrate words and visuals used to teach computer applications into one delivery medium.
   a. Prevents split-attention; a source of extraneous load, which would require learners to integrate two or more dependent sources of information that are physically separated.

Weed Your Instruction to Manage Limited Working Memory Capacity

8. Pare content down to essentials.
9. Eliminate extraneous visuals, text, and audio.
10. Eliminate redundancy in content delivery modes.

   a. Minimize cognitive load by presenting your content as concisely as possible, omitting words, visuals, or audio that do not contribute to understanding.
   b. Avoid increasing cognitive load by delivering the same content via multiple modalities (e.g., text narrated by audio).

Provide External Memory Support to Reduce Working Memory Load

11. Provide performance aids as external memory supplements.
12. Design performance aids by applying cognitive load management techniques.
    a. Performance aids (e.g., procedure guides) package content required for task completion in a format that is readily accessible when needed in the work and learning environment.
    b. Use visuals as the predominant display for spatial content; avoid redundancies and split-attention.
    c. If applicable, fade memory support as training progresses.

Use Segmenting, Sequencing, and Learner Pacing to Gradually Impose Content

13. Teach system components before teaching the full process.
14. Teach supporting knowledge separate from the teaching procedure.
    a. Manage intrinsic load through segmenting and sequencing your content.
    b. Focus on minimizing the amount of new content being processed in working memory at one time.

Use Segmenting, Sequencing, and Learner Pacing to Gradually Impose Content

15. Consider the risks of cognitive overload before designing whole-task learning environments.
    a. Consider research that highlights the challenges of problem-based learning:
       i. Kirschner, Sweller, & Clark, 2006
       ii. Mayer, 2004
16. Give learners control over pacing and manage cognitive load when pacing must be instructionally controlled.
    a. Novices are typically burdened with a high cognitive load when asked to make pacing decisions while learning new content.

Transition from Worked Examples to Practice to Impose Mental Work Gradually

17. Replace some practice problems with worked examples.
    a. Worked examples can provide equivalent learning results as practice only in less time and with less learner effort.

18. Use completion examples to promote learner processing of examples.
   a. Learners may be inclined to skip worked examples and thereby bypass their benefits; thus, use chaining procedures to engage learners with the worked example.

Transition from Worked Examples to Practice to Impose Mental Work Gradually

19. Transition from worked examples to problem assignments with backwards chaining.
   a. Move from worked examples into completion examples and finish with full practice assignments. This comprehensive sequence minimizes cognitive load while allowing for efficient building of schemas over time.

20. Display worked examples and completion examples in ways that minimize extraneous cognitive load.
   a. Apply modality and split-attention principles and utilize audio narration of steps and cueing of related visuals.

Put Working Memory to Work with Germane Load

21. Use diverse worked examples to foster transfer of learning.
   a. Worked examples should be linked by common structural features.
   b. Varied context examples can build principle-based schemas, but do increase cognitive load—so be mindful of your audience. Typically, this approach is adopted to accomplish far transfer goals.

22. Help learners exploit examples through self-explanations.
   a. Productive self-explanations include (a) monitor and correct, (b) try and check, and (c) make inferences by associating the examples with underlying principles or prior knowledge.

23. Help learners automate new knowledge and skills.

24. Promote mental rehearsal of complex content after mental models are formed.
   a. Many rehearsal opportunities are necessary to accomplish automaticity over time.
   b. For complex tasks, learners have to first build basic schemas through worked and completed examples. Afterwards, mental rehearsal can help automate them.

Accommodate Differences in Learner Expertise

25. Write highly coherent texts for low-knowledge readers.

26. Avoid interrupting the reading of low-skilled readers.
   a. Low knowledge readers should receive text guidance, including (a)

organizing sentences or diagrams, (b) definitions and examples of unfamiliar terms, (c) explicit directions or questions that require minimal inferences, and (d) headers to signal paragraph topics.

    b. Higher-skilled readers' comprehension benefits from questions during reading assignments.

27. Eliminate redundant content for more experienced learners.

    a. Experienced learners do not benefit from the combination of text and audio. If the text is self-explanatory, keep it rather than producing diagrams.

28. Transition from worked examples to problem assignments as learners gain expertise.

    a. Once learners have formed their own schemas for performing a task, they are better off solving problems based on those schemas.

29. Use directive rather than guided discovery learning designs for novice learners.

    a. Novice learners benefit the most from directive lessons featuring brief content segments that include explanations, examples, and practice.
    b. Experienced learners can utilize both approaches.

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