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CENTER FOR EDUCATION POLICY ANALYSIS, RESEARCH, AND EVALUATION (CEPARE)

Strengthening Mathematics Recovery in Connecticut: Research-Informed Priorities for Local Districts

Katherine Mack CEPARE Rapid Research Brief October 2026

The COVID-19 pandemic disrupted classroom learning nationwide, and mathematics results from the National Assessment of Educational Progress (NAEP), often called the Nation's Report Card, reflect broad declines followed by an incomplete and unequal recovery. National Grade 4 NAEP mathematics performance declined between 2019 and 2022 and then recovered only partially by 2024. Between 2022 and 2024, gains were concentrated at the middle and upper portions of the achievement distribution. Students at the 10th and 25th percentiles showed no statistically significant change (NCES, n.d.-a).

Connecticut has begun to recover some of the ground lost on its state assessments, yet the pace and distribution of improvement warrant continued attention. This brief considers how the state might build on these gains to support sustained, equitable improvement without allowing score pressure to drive accelerated content coverage or disconnected remediation that limits students' access to meaningful mathematics. Longitudinal evidence linking early number competence to later achievement underscores the importance of using recovery efforts to strengthen foundational number knowledge that students have not yet fully developed (Geary et al., 2013; Jordan et al., 2009).

Connecticut's mathematics results show encouraging movement on state assessments, but the state has not returned to pre-pandemic performance.

Fifteen states/jurisdictions recorded statistically significant gains in average Grade 4 NAEP mathematics scores from 2022 to 2024 (NCES, n.d.-c). This brief examines Alabama, Kentucky, and Louisiana because their official legislation and implementation materials illustrate policy mechanisms relevant to the brief's three focal areas: early numeracy, mathematics-specific professional learning, and mathematical proficiency.

This brief is guided by three questions:

- What priorities and implementation strategies recur across the selected states' policy and implementation documents?
- How do these priorities and strategies align with the broader research base on elementary mathematics learning and instruction?
- Which research-informed priorities could Connecticut districts adapt to their local contexts while building on existing state infrastructure?

Connecticut's Mathematics Context

Connecticut's state-assessment trend provides evidence of real but unfinished progress. The statewide mathematics Performance Index increased from 58.6 in 2021–22 to 59.7 in 2022–23, 60.2 in 2023–24, and 61.1 in 2024–25. CSDE reported improvement in 2024–25 across every reported student group. Nevertheless, the statewide index remained below its 2018–19 level of 63.1, and the 2024–25 high-needs index of 50.6 remained below its 2018–19 level of 52.7 (CSDE, 2025b, 2025c).

NAEP results present a more cautious picture. Connecticut's Grade 4 average declined from 243 in 2019 to 236 in 2022 before rising to 239 in 2024. Its Grade 8 average declined from 286 in 2019 to 276 in 2022 before rising to 277 in 2024. Neither change from 2022 to 2024 was statistically significant (CSDE, 2025a; NCES, 2025a, 2025b).

Connecticut's Grade 4 NAEP content-domain averages declined across all five domains from 2019 to 2022 and showed only partial recovery by 2024. Number Properties and Operations fell from 246 to 239 before rising to 243; Measurement, from 244 to 237 to 239; Geometry, from 235 to 228 to 229; Algebra, from 245 to 239 to 241; and Data Analysis, Statistics, and Probability, from 240 to 233 to 235 (NCES, n.d.-b). Because the declines extend across every reported domain, the results do not indicate that Connecticut's performance patterns are concentrated within a single content strand. Because the pattern is not concentrated in one domain, this brief examines cross-cutting conditions identified in the broader research base, including opportunity to learn, teacher expertise, and the alignment of instruction and assessment (American Educational Research Association et al., 2014; Cobb, 1994; Phelps et al., 2012; Shepard, 2000).

CSDE's 2024–25 reporting shows higher statewide mathematics Performance Index values in Grades 3 and 4—63.6 and 67.4, respectively—than in Grades 8 and 11, where the corresponding values were 58.8 and 50.1. Although these values reflect different cohorts and should not be interpreted as a longitudinal decline, they provide additional context for examining the coherence of mathematics learning opportunities across grade bands (CSDE, 2025c). Substantial disparities also remain: compared with the statewide mathematics Performance Index of 61.1, the index was 50.6 for students identified as high needs, 50.2 for students eligible for free or reduced-price meals, 49.4 for students classified by CSDE as English learners, and 40.9 for students with disabilities (CSDE, 2025c). This suggests that recovery should be evaluated not only through statewide averages but also by whether students across classrooms and groups receive protected access to high-quality Tier 1 instruction and supplemental support that extends rather than narrows their mathematical opportunities.

Notably, CSDE already provides mathematics standards and resources (CSDE, n.d.-c), and its Math Walkthrough Tool articulates a broad vision of proficiency that includes conceptual understanding, procedural fluency, application, problem solving, reasoning, and student explanation (CSDE, n.d.-b). A joint statement authored by three Connecticut mathematics organizations in 2022, developed in collaboration with CSDE and endorsed by the State Board of Education in 2023, calls for mathematics to receive priority comparable to literacy, for sustained professional learning and coaching, and for a parallel system of mathematics support (Associated Mathematics Teacher Educators in Connecticut et al., 2022; Connecticut State Board of Education, 2023). CSDE's 2026 Alliance District professional learning also centers opportunity, access, engagement, and coherence in mathematics (CSDE, 2026). The recommendations that follow are designed for local examination and adaptation while aligning with and strengthening this existing state infrastructure.

Priority 1: Strengthen Early Numeracy Through Coherent Tier 1 Infrastructure

The importance of early number knowledge extends far beyond the years in which it is first developed; longitudinal evidence links it to mathematics achievement many years later. At the beginning of first grade, knowledge of systematic relations among written numerals predicted functional numeracy more than six years later (Geary et al., 2013). Other longitudinal studies associate preschool and kindergarten number competence—including counting, cardinality, number relations, early arithmetic, and problem solving—with mathematics achievement through Grades 3 and 5 (Jordan et al., 2009, 2010; Nguyen et al., 2016). Studies also document developmental changes in numerical-estimation representations and positive associations between estimation skill and mathematics achievement (Booth & Siegler, 2006; Siegler & Booth, 2004). Together, these findings provide a rationale for caution about recovery strategies that accelerate coverage of later content without also strengthening foundational understandings that students have not yet fully developed.

A central systemic concern is students' opportunity to learn. Mathematics instructional time varies substantially across classrooms and schools (Phelps et al., 2012). Districts should examine whether local schedule disruptions, shortened days, intervention arrangements, or competing priorities contribute to that variation. When time for foundational work is inconsistent, access to mathematical reasoning can become contingent on classroom context rather than student need. Protecting a coherent Tier 1 mathematics period—the core mathematics instruction provided to all students—could reduce schedule-based variation and signal that early mathematics is a core instructional responsibility.

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A coherent Tier 1 mathematics period is a structural condition for consistent opportunity to learn, but time alone is insufficient. For protected time to support stronger learning, it must be paired with coherent curriculum and instruction that make number relationships and student thinking visible. Students need regular opportunities to compose and decompose quantities, compare strategies, and connect concrete, visual, and symbolic representations (National Council of Teachers of Mathematics [NCTM], 2014a, 2020). Work with magnitude and estimation should likewise help students develop and coordinate numerical representations (Booth & Siegler, 2006; Siegler & Booth, 2004).

Alabama's recent Grade 4 mathematics gains warrant closer examination of the state's recovery efforts. From 2022 to 2024, the state's average NAEP mathematics score increased six points, from 230 to 236, and Alabama was the only state to surpass its 2019 pre-pandemic Grade 4 mathematics score (NCES, n.d.-c). Although these gains cannot be attributed to any single policy, the Alabama Numeracy Act offers an operational example of how a state can pair protected instructional opportunity with explicit expectations for instructional quality. The law requires an average of at least 60 minutes per day of Tier 1 mathematics instruction in Grades K–5 while calling for instruction grounded in conceptual understanding, strategic reasoning, problem solving, student discourse, questioning, and critique (Alabama Numeracy Act, 2022, § 5). Kentucky and Louisiana provide complementary examples of state-level support for mathematics improvement, with Kentucky emphasizing recurring coaching cycles and Louisiana investing in substantial mathematics-specific professional learning for teachers (KDE, 2023; Louisiana Department of Education, 2024).

Connecticut's Grade 4 NAEP results also show incomplete recovery across all five reported content domains (NCES, n.d.-b).

Recommended Actions

- **Districts and schools.** Audit both scheduled and enacted mathematics time, then protect a coherent Tier 1 mathematics period across delayed openings, assemblies, intervention schedules, and other recurring disruptions so that foundational work remains embedded in the core mathematics program. Review instructional tasks and student work to monitor the quality of students' opportunities to learn, not minutes alone.
- **Supplemental support and equity.** Ensure that intervention extends the same mathematical ideas and representations emphasized in Tier 1 while preserving students' access to grade-level tasks, discussion, and problem solving. Materials and routines should support multilingual learners and students with disabilities without narrowing their mathematical opportunities to isolated drill or routine answer production (Fuchs et al., 2021; NCTM, 2020).
- **Families and communities.** Offer optional, accessible resources that help families notice and discuss mathematics in everyday routines—for example, comparing quantities while cooking, estimating totals, noticing patterns, or playing strategy games. Home numeracy experiences are

associated with children's early mathematics outcomes (LeFevre et al., 2009; Skwarchuk et al., 2014), but they should supplement, not substitute for, schools' responsibility to provide high-quality instruction.

- **Implementation evidence.** Track scheduled and enacted mathematics time, students' access to reasoning-rich tasks, alignment between Tier 1 instruction and intervention, and variation in opportunity to learn across classrooms and student groups.

Priority 2: Build Sustained Mathematics-Specific Instructional Expertise

Protected time creates the opportunity to learn, while mathematics-specific professional preparation deepens its value by enriching students' mathematical experiences and strengthening teachers' practice. From a sociocultural perspective, mathematical learning develops not only within individuals but through participation in socially organized classroom activity (Cobb, 1994). Mathematics-specific preparation therefore matters because teachers shape that activity by interpreting partial strategies, connecting initial student thinking to representations and formal notation, selecting and sequencing student ideas, and maintaining cognitive demand during discussion (NCTM, 2014a; Schoenfeld, 1992). A Number Talk, for example, depends heavily on the questions teachers pose and the connections they help students make among strategies (Joswick et al., 2025).

Kentucky's Mathematics Achievement Fund illustrates one practice-embedded approach. Its coaching rubric organizes recurring cycles of planning, data gathering and observation, and reflection, supported by release time and training (Kentucky Department of Education [KDE], 2023). Louisiana illustrates a different state-level mechanism: a requirement that Grades 4–8 teachers complete a mathematics-specific course consisting of 25 modules and approximately 50 hours by August 1, 2025 (Louisiana Department of Education, 2024). Together, these cases illustrate two distinct policy mechanisms for professional learning: job-embedded coaching and structured mathematics-specific learning for teachers.

Connecticut has several assets on which a stronger system could build, including recent Alliance District mathematics convenings, the Math Walkthrough Tool, and the joint equity position statement (Associated Mathematics Teacher Educators in Connecticut et al., 2022; CSDE, n.d.-a, 2026). The reviewed state materials do not document a sustained statewide structure through which all districts receive recurring mathematics-specific professional learning, coaching, and leadership development. In addition, CSDE does not currently list a dedicated mathematics consultant endorsement parallel to its Reading and Language Arts Consultant endorsement (CSDE, 2022). This contrast is not a judgment of the expertise or commitment of current mathematics coaches and leaders. Instead, it raises an implementation question: How are local mathematics leadership roles defined and resourced, and how are the professionals serving in those roles prepared, empowered, and supported?

Recommended Actions

- **Districts and schools.** Focus professional learning on a small number of shared practices and mathematical ideas, revisiting them across the year rather than layering on disconnected routines or initiatives. Organize recurring cycles in which teachers plan, teach, examine student work or brief classroom video, analyze how tasks, representations, and questions shaped student reasoning, and refine instruction. Where formal coaching positions are not feasible, prepare and compensate grade-band teacher leaders to facilitate these cycles.
- **Role design and local resourcing.** Protect coaches and teacher leaders from being routinely diverted to testing coordination or substitute coverage. Provide release time and sustained access to mathematics-specific learning. Professional organizations such as NCTM can broaden access to professional learning and networks, but membership should complement—not substitute for—job-embedded professional learning.
- **State agencies and policymakers.** Provide dedicated, recurring support for mathematics-specific professional learning, coaching, teacher-leader release time, and implementation evaluation. Consider clearer preparation and role expectations for mathematics leadership positions while allowing districts flexibility in how those roles are organized.
- **Implementation evidence.** Document the frequency, continuity, and quality of coaching or professional learning community (PLC) cycles; teacher and leader participation; and changes observed in instructional tasks, representations, questioning, and discourse.

Together, the first two priorities address students' opportunity to learn and educators' capacity to make that opportunity meaningful. The third turns to whether assessments and other system signals reinforce the same vision of mathematics.

Priority 3: Align Measures of Proficiency With Reasoning and Balanced Fluency

Automatic recall of basic facts is an important outcome of mathematics learning, but speed under pressure should not serve as the primary proxy for fluency or proficiency. In many elementary settings, recall—via flashcards, timed quizzes, or rapid digital practice—is common despite educational taxonomies that distinguish recall from higher-order processes such as analysis, application, and transfer (Anderson & Krathwohl, 2001; Bloom, 1956). NCTM defines procedural fluency as the ability to use procedures accurately, efficiently, and flexibly and emphasizes that fluency develops in connection with conceptual understanding (NCTM, 2014a, 2014b). Conceptual understanding and procedural skill can develop iteratively rather than as competing alternatives (Rittle-Johnson et al., 2001). Balanced fluency therefore includes appropriate automaticity while also attending to strategy selection, representation, explanation, and the ability to adapt or apply knowledge in unfamiliar situations. Under this multidimensional definition, performance on a timed task alone provides incomplete evidence of procedural fluency (NCTM, 2014b).

This priority is motivated by concerns about assessment validity and instructional coherence. When a district defines fluency broadly but relies on timed tests, the measure may underrepresent the construct it is intended to assess (American Educational Research Association et al., 2014). A speed score can provide useful information about performance under specified conditions, but it does not independently establish flexibility, conceptual understanding, strategy selection, or transfer. Local assessment and reporting systems should therefore elicit evidence that corresponds to the full construct districts say they value.

Assessment systems can influence instructional priorities and classroom learning cultures (Au, 2007; Shepard, 2000). Districts should therefore examine whether district-facing and family-facing communications further reinforce particular forms of performance as evidence of mathematical competence. Strategy-based approaches offer one instructional route toward efficiency without reducing fluency to speed. Bay-Williams and Kling describe approaches that develop efficient fact use through mathematical models, relationships, and flexible strategies (Bay-Williams & Kling, 2019; Kling & Bay-Williams, 2015). Frequent and purposeful practice remains important, but evidence of automaticity is most informative when interpreted alongside students' strategy use, representations, explanations, and ability to apply knowledge flexibly.

Mathematics anxiety provides an additional reason to examine how fluency is assessed and communicated. Meta-analytic research documents a negative association between mathematics anxiety and mathematics achievement, while also suggesting that the relationship is complex and potentially reciprocal (Barroso et al., 2021; Namkung et al., 2019). In one longitudinal study, first-grade students identified task difficulty, time pressure, risk of failure, and fear of receiving a poor grade among their reported reasons for mathematics anxiety (Szczygieł & Pieronkiewicz, 2022). More recent research with fourth- and fifth-grade students found that task complexity, rather than overt timing alone, was associated with higher reported anxiety (Maki et al., 2024). Together, this evidence supports caution about making speed-dominant, high-pressure formats an indicator of proficiency; it does not establish that every timed task is harmful.

In many elementary settings, recall—via flashcards, timed quizzes, or rapid digital practice—is common despite educational taxonomies that distinguish recall from higher-order processes such as analysis, application, and transfer (Anderson & Krathwohl, 2001; Bloom, 1956).

Alabama's Numeracy Act provides a state illustration by pairing expectations for fluency with conceptual understanding, strategic reasoning, student discourse, and sense making (Alabama Numeracy Act, 2022, § 5). Connecticut's mathematics guidance and instructional walkthrough tool already articulate a similarly broad vision of proficiency that includes conceptual understanding, procedural fluency, application, reasoning, and student explanation (CSDE, n.d.-a, n.d.-b).

The district-level priority, then, is to examine whether the measures, practices, and messages encountered locally—including fluency assessments, district benchmarks, intervention screeners, walkthrough criteria, coaching feedback, grading practices, and family communications—align with that vision and to address inconsistencies where they are found.

Recommended Actions

- **Districts and schools.** Audit local fluency measures, benchmark assessments, intervention tools, walkthrough forms, report-card language, and family communications. Identify where speed functions as the primary or most visible signal of competence, then supplement or replace those measures with evidence of strategy use, representation, explanation, and reasoning. Do not use timed fact tests as the primary measure of fluency; when a timed measure serves a specific diagnostic purpose, interpret it alongside other evidence and avoid public ranking or high-stakes labeling.
- **Classroom practice.** Provide regular opportunities for students to compare strategies, use number lines, arrays, equations, and other representations, and explain why a method works. Frequent and purposeful practice remains important, but it need not rely primarily on drill. The aim is not to choose between understanding and efficiency, but to develop efficient procedures through connected understanding.
- **Implementation evidence.** Establish a baseline by conducting a review of a representative sample of local assessments, intervention tools, walkthrough forms, report-card language, and family communications to identify the forms of mathematical evidence they prioritize. After changes are introduced, examine whether the range of evidence elicited has broadened; whether classroom tasks, teacher feedback, and student explanations have shifted; and whether students demonstrate changes in fact accuracy and automaticity, strategy flexibility, or representational fluency.

Conclusion

Alabama, Kentucky, and Louisiana illustrate three distinct ways states have translated research-aligned mathematics priorities into policy and implementation. Alabama protects Tier 1 instructional time while pairing reasoning-centered expectations with coaching; Kentucky structures professional learning around sustained coaching cycles; and Louisiana requires substantial mathematics-specific professional learning (Alabama Numeracy Act, 2022; KDE, 2023; Louisiana Department of Education, 2024). The observed NAEP gains do not establish that these policies caused the states' improvements. Rather, the examples demonstrate how priorities supported independently by the broader research base—including early number knowledge, practice-embedded professional learning, and fluency grounded in understanding—can be operationalized through legislation, guidance, professional learning, and local implementation (Geary et al., 2013; Jordan et al., 2009; NCTM, 2014a, 2014b).

Taken together, the evidence points to a coherent direction for Connecticut. The NAEP patterns indicate that the state's incomplete recovery extends across mathematical content domains rather than being concentrated in a single strand. The selected state examples show how related priorities can take concrete form in policy and implementation, while the broader research base provides the primary support for the recommendations. For Connecticut districts, the most defensible path is therefore to strengthen and connect existing efforts: emphasize early-numeracy progressions while

protecting opportunities to learn; develop sustained mathematics-specific leadership and professional learning; and align local assessments, walkthroughs, and instructional messages with a balanced conception of mathematical proficiency.

These efforts should be adequately resourced, piloted, and evaluated, with explicit attention to multilingual learners, students with disabilities, and economically disadvantaged students. Durable progress is most likely when students' foundational mathematical understanding, educators' instructional capacity, and the assessments and messages that shape local practice reinforce one another over time.

Methods Note

This brief uses Connecticut's NAEP and state-assessment trends to characterize the scope and distribution of mathematics recovery and to identify areas calling for further examination. National Grade 4 trends and percentile results are drawn from the 2024 NAEP mathematics report (NCES, n.d.-a). Connecticut Grade 4 and Grade 8 averages and significance comparisons are drawn from the 2024 state snapshot reports and CSDE's summary (CSDE, 2025a; NCES, 2025a, 2025b). Connecticut Grade 4 content-domain averages were generated in the NAEP Data Explorer for Connecticut public schools, all students, in 2019, 2022, and 2024 (NCES, n.d.-b).

Because the Grade 4 content-domain patterns did not identify a single strand as a principal area of incomplete recovery, the analysis examines cross-cutting instructional and organizational conditions that may support learning across mathematical domains. Alabama, Kentucky, and Louisiana were selected from the 15 states with statistically significant Grade 4 NAEP mathematics gains from 2022 to 2024 (NCES, n.d.-c) because their official legislation and implementation materials were publicly available and relevant to the priorities examined. These states are treated as illustrative policy cases, not as causal evidence that the identified policies produced their score gains. Their approaches are interpreted alongside an independent research base and Connecticut's existing mathematics infrastructure in developing recommendations for local district adaptation.

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CEPARE produces high-quality research, evaluation, and policy analysis that informs leaders and policymakers on a range of pressing issues, with a particular focus on enhancing social justice and equity across p-20 educational settings in Connecticut and beyond. CEPARE produced this brief as part of the SETER Alliance, which aims to strengthen and support learning opportunities in Connecticut's Alliance districts.

Author Biography



Katherine Mack

Katherine Mack is a doctoral student in Curriculum & Instruction with a concentration in Elementary Education at the Neag School of Education, University of Connecticut. Drawing on her background in English (B.A.), Elementary Education (M.S.), and more than ten years of experience in elementary classrooms, she studies how teachers can facilitate mathematical discourse in ways that center student reasoning and make it visible. Her research focuses particularly on how preservice teachers plan for, enact, and reflect on the use of the instructional board as a shared space for representing mathematical ideas.

At UConn, Katherine teaches in the Integrated Bachelor's/Master's (IB/M) teacher preparation program and collaborates on grant-funded research initiatives focused on discourse, reasoning, and teacher learning. She has presented her work at NCTM conferences and other regional and national conferences, including ATOMIC, the NCTE–NCTM Joint Conference, and NC-FEW, and has contributed to related publications. Through her teaching and research, she is committed to preparing future elementary teachers to create mathematics classrooms where student thinking is visible, valued, and used to advance learning.