



# The National Mathematics Achievement Recovery and Equity Framework (NMAREF)

*A Comprehensive Policy Framework for Post-Pandemic Mathematics Recovery and Educational Equity in the United States*

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## PART I: EXECUTIVE SUMMARY, CONTEXT, AND FRAMEWORK DESIGN

### I. Executive Summary

Mathematics achievement in the United States has declined steeply over more than half a century. The National Assessment of Educational Progress (NAEP) reported that nine-year-old students lost seven points in mathematics from 2020 to 2022, the sharpest downturn since the long-term trend assessment began [1]. Eighth-grade scores fell eight points between 2019 and 2022, the most significant drop in the history of the primary NAEP cycle [2]. Research from the *Education Recovery Scorecard* project, led jointly by Stanford and Harvard Universities, shows that while some affluent districts have recovered, most American students remain nearly half a grade level behind in math performance [3].

These setbacks threaten national innovation, economic productivity, and STEM-workforce readiness. The National Mathematics Achievement Recovery and Equity Framework (NMAREF) offers an evidence-based, scalable solution grounded in three interdependent pillars:

1. Standardized Diagnostics and Progress Dashboards to monitor learning trajectories through equitable, data-driven systems;
2. Data-Driven Formative Instruction and Teacher Capacity Building to convert analytics into effective teaching practice; and
3. Culturally Responsive and Inclusive Pedagogy to ensure mathematics learning environments reflect diversity, accessibility, and inclusion.

Aligned with the Every Student Succeeds Act (ESSA) and the Federal STEM Education Strategic Plan (2024–2028), NMAREF transforms fragmented recovery efforts into a national policy blueprint linking diagnostic precision, professional learning, and instructional equity.



## II. Introduction and Rationale

### 1. Post-Pandemic Mathematics Decline

The COVID-19 pandemic disrupted more than two years of in-person instruction across the United States, leaving enduring academic scars. The 2022 NAEP *Long-Term Trend Assessment* documented that mathematics scores among nine-year-olds declined by seven points—the equivalent of losing roughly three-quarters of an academic year [1]. Eighth-grade mathematics dropped eight points, and fourth-grade scores fell five points [2]. These declines are not evenly distributed: lower-income, Black, Hispanic, and rural students lost disproportionately more ground [4].

The *Education Recovery Scorecard* further revealed that students in high-income districts were four times more likely to regain pre-pandemic achievement levels than those in low-income districts [3]. Girls—historically performing on par with boys—have now fallen about one-third of a grade level behind [5]. Such trends expose deep structural inequities jeopardizing social mobility and long-term national competitiveness.

### 2. Policy Mandates and Federal Alignment

The Every Student Succeeds Act (ESSA) (2015) requires that all underperforming schools implement *evidence-based interventions* demonstrating statistically significant improvements in student outcomes [6]. Parallely, the Federal STEM Education Strategic Plan (2024–2028) identifies mathematics proficiency as foundational to building a *STEM-literate nation* and achieving equitable participation across demographic groups [7].

Yet, as *Elementary and Secondary School Emergency Relief (ESSER)* funds expire, states face declining fiscal support for recovery initiatives. The Institute of Education Sciences (IES) warns that learning recovery will stall without long-term, data-integrated frameworks [8]. NMAREF addresses this policy vacuum by institutionalizing continuous diagnostics, capacity building, and equity auditing as permanent components of educational governance.

## III. Framework Design and Core Pillars

The NMAREF model is structured as a multi-level, systemic framework adaptable to district and state contexts. It integrates educational measurement, teacher professionalization, and inclusivity within one cohesive system.

### Pillar 1 – Standardized Diagnostics and Progress Dashboards

**Purpose.** To generate accurate, comparable, and actionable data for educators, administrators, and policymakers.

- **Diagnostics.** Develop vertically-scaled, norm-referenced assessments that measure numeracy, algebraic reasoning, and problem-solving across K–12 levels. Adaptive algorithms minimize ceiling and floor effects [9].



- **Progress Monitoring.** Implement bi-weekly or monthly low-stakes assessments feeding directly into secure data dashboards.
- **Dashboards.** Interactive platforms will disaggregate data by race, gender, language, disability, and socioeconomic status to identify disparities and target interventions while maintaining FERPA compliance [10].

**Rationale.** Without standardized diagnostics, teachers often rely on inconsistent grading or summative tests that obscure real-time learning needs. Studies demonstrate that formative assessment systems correlated with NAEP benchmarks produce higher student gains and more equitable outcomes [11].

### **Pillar 2 – Data-Driven Formative Instruction and Teacher Capacity Building**

**Purpose.** To empower educators to transform raw data into instructional insight and innovation.

- **Formative Cycles.** Adopt a *collect, analyze, and respond model* in which teachers gather quick performance data, analyze misconceptions, adapt lessons, and reassess [12].
- **Professional Development (PD).** Offer blended PD combining workshops, online modules, and on-site coaching. Introduce **micro-credentialing** to certify mastery in data literacy, differentiated instruction, and assessment design [13].
- **Professional Learning Communities (PLCs).** Facilitate collaborative inquiry groups where educators co-interpret data, share practices, and align strategies.
- **Mentorship and Coaching.** Deploy trained instructional coaches who model evidence-based lessons and co-teach with faculty during implementation phases [14].

**Evidence Base.** Programs such as *Math Recovery®* and *Response to Intervention (RTI)* demonstrate that structured diagnostic tutoring combined with teacher PD yields significant gains for struggling learners [15]. NMAREF institutionalizes these findings at the district scale.

### **Pillar 3 – Culturally Responsive and Inclusive Pedagogy**

**Purpose.** To ensure mathematics instruction affirms cultural identity, promotes belonging, and removes systemic barriers to participation.

- **Culturally Relevant Curriculum.** Integrate mathematics tasks grounded in community contexts such as financial literacy, local environmental data, or public-health modeling [16].
- **Universal Design for Learning (UDL).** Provide multiple modes of representation (visual, auditory, kinesthetic) and expression (oral, written, digital) for learners of all abilities [17].
- **Equity Audits.** Conduct audits to evaluate access to advanced courses, teacher expectations, and resource distribution across subgroups.
- **Mathematical Discourse.** Encourage dialogic classrooms where students explain reasoning, question peers, and co-construct understanding [18].



**Rationale.** Culturally responsive pedagogy has been linked to improved academic engagement and achievement among underrepresented populations [19]. Embedding such practices in mathematics strengthens both conceptual understanding and inclusivity.

## Part II: Implementation, National Urgency, and Policy Integration

### *IV. Implementation Framework and Evaluation Strategy*

Implementing the National Mathematics Achievement Recovery and Equity Framework (NMAREF) is structured into four progressive phases spanning approximately 24 months. Each phase builds capacity at multiple levels—teacher, school, and system—ensuring that recovery efforts are sustained beyond initial funding cycles.

#### *Phase 1 – Planning and Pilot (Months 1–4)*

- **Pilot District Selection.**  
Identify three to five high-need districts exhibiting significant mathematics learning losses, prioritizing those with high poverty rates, large English learner populations, or rural isolation. These districts serve as “proof-of-concept” sites demonstrating scalability and equity alignment.
- **Stakeholder Engagement.**  
Convene district leaders, instructional coaches, teachers, and community representatives to establish shared goals and implementation benchmarks. Stakeholder inclusion ensures the framework’s local relevance and ownership.
- **Diagnostic Tool Development.**  
Create item banks, scaling matrices, and dashboard prototypes aligned with NAEP and state standards. Early piloting generates validity data for refinement.
- **Professional Induction.**  
Conduct introductory workshops and microlearning sessions on data interpretation, cultural responsiveness, and formative assessment cycles [20].

#### *Phase 2 – Pilot Implementation and Iteration (Months 5–12)*

- **Baseline Administration.**  
Launch standardized diagnostics and populate dashboards with student performance data.
- **Coaching and PLC Cycles.**  
Teachers engage in bi-weekly PLC meetings to discuss findings, plan instructional adjustments, and share challenges. Instructional coaches facilitate modeling, observation, and feedback loops [21].
- **Equity Audit.**  
Districts conduct an initial audit to assess participation rates in advanced math courses, resource access, and subgroup disparities. Data findings inform targeted resource allocation.



- **Iterative Refinement.**

Framework components are adjusted based on teacher feedback and early outcome metrics, ensuring adaptability across contexts.

**Phase 3 – Expansion and Institutionalization (Months 13–20)**

- **Scaling Across Grade Levels.**

Expand diagnostic assessments and dashboard usage district-wide. Integrate vertical alignment from elementary to high school to ensure continuous tracking of learning growth [22].

- **Capacity Building.**

Train district-based “Math Lead Educators” to mentor peers, ensuring sustainable professional development. Partner with universities to embed framework content in teacher preparation curricula.

- **Data Culture Integration.**

Embed data analysis protocols into staff meetings and annual improvement planning, normalizing evidence-based decision-making.

**Phase 4 – Statewide Rollout and Sustainability (Months 21–24)**

- **Policy Alignment.**

Collaborate with state departments of education to incorporate NMAREF principles into statewide ESSA plans, teacher standards, and school improvement rubrics.

- **Long-Term Evaluation.**

Utilize quasi-experimental designs comparing NMAREF and non-NMAREF districts to assess program impact on student achievement, teacher retention, and equity outcomes [23].

- **Toolkit Publication.**

Develop open-access toolkits and digital training modules to support replication by additional states and districts.

**Evaluation Metrics and Accountability**

Evaluation of NMAREF is guided by three outcome tiers:

Level	Indicators	Data Source
<b>Student Outcomes</b>	Growth on diagnostic assessments, proficiency rates on state tests, reduction of subgroup achievement gaps	Dashboard analytics, state testing reports
<b>Teacher Outcomes</b>	Microcredential completion rates, classroom observation scores, professional engagement	PD records, coach evaluations
<b>System Outcomes</b>	Dashboard utilization, policy adoption, cost-effectiveness	District reports, independent audits



Continuous improvement cycles will incorporate quarterly data reviews, semi-annual equity audits, and annual policy evaluations. Feedback from educators and students will inform iterative refinements to maintain contextual relevance [24].

## V. National Urgency and Strategic Relevance

### 1. The National Crisis of Learning Loss

The magnitude of U.S. mathematics learning loss constitutes a national emergency. The Brookings Institution estimates that global pandemic-related learning disruptions could result in lifetime income losses exceeding \$17 trillion, with the U.S. contributing a significant share due to persistent achievement gaps[25]. Research from McKinsey & Company confirms that, as of 2023, students remain five months behind in mathematics, with widening disparities across racial and income lines [26].

Mathematics is not only an academic discipline but also an economic driver. The U.S. Bureau of Labor Statistics projects that 70% of all new STEM jobs in the next decade will require strong quantitative reasoning. Failure to rebuild national proficiency threatens workforce readiness, global competitiveness, and technological innovation capacity [27].

### 2. The Equity Imperative

The urgency extends beyond academics to social justice. Disparities in mathematics proficiency mirror—and exacerbate—structural inequalities. Black, Hispanic, and Native American students are significantly underrepresented in advanced math tracks and STEM professions[28].

NMAREF's emphasis on *data disaggregation* and *culturally responsive pedagogy* directly addresses these inequities by ensuring every student's progress is visible and supported.

By bridging diagnostic data with inclusive teaching, the framework operationalizes educational equity as a measurable outcome, not an aspirational ideal.

### 3. The Uniqueness of the Framework

NMAREF's distinguishing feature is its integration of measurement, instruction, and inclusion. Where other recovery programs isolate one variable—tutoring, PD, or curriculum—NMAREF unites them within a continuous improvement system. Its design embodies three key differentiators:

- **Systemic Scalability:** Capable of adaptation across state and district contexts without compromising validity or equity.
- **Embedded Sustainability:** Built around recurring data cycles and professional learning rather than temporary grants.
- **Human-Centered Equity:** Integrates Universal Design for Learning (UDL) and culturally relevant pedagogy to affirm the identities of all learners, including those with disabilities and multilingual backgrounds [29].





This integrative structure renders NMAREF a unique contribution to U.S. educational innovation and a model for future federal-state collaboration.

## **VI. Policy Integration and Multi-Level Collaboration**

### **1. Federal and State-Level Alignment**

Federal agencies can institutionalize NMAREF principles through targeted funding streams supporting diagnostic infrastructure and educator credentialing. State education departments can embed framework metrics in accountability systems and teacher evaluation standards. The National Science Foundation (NSF) and Institute of Education Sciences (IES) should co-sponsor longitudinal studies assessing its long-term impact on academic outcomes and workforce preparedness [30].

### **2. District and Local Leadership**

District superintendents and curriculum directors play critical roles in operationalizing the framework. They can leverage existing networks—Professional Learning Communities, School Improvement Teams—to embed data literacy and cultural competence into routine operations [31]. Sustaining NMAREF requires local ownership: aligning budgets, incentives, and community partnerships with recovery objectives.

### **3. Higher Education and Research Partnerships**

Teacher preparation institutions can collaborate with K–12 districts to align coursework with NMAREF's pillars, ensuring pre-service teachers enter the field with skills in data analytics, differentiation, and culturally responsive instruction. Research universities can evaluate framework effectiveness through mixed-methods studies combining quantitative outcomes and qualitative teacher insights [32].

### **4. Community and Private Sector Engagement**

Community organizations and private foundations can extend NMAREF's reach through after-school enrichment, tutoring, and digital literacy programs. Corporate partners in the STEM industries can support internships and mentorship pipelines linking K–12 math achievement to career pathways [33].

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## **VII. Call to Action**

The evidence is unequivocal: delaying systemic mathematics recovery will entrench inequity and reduce national prosperity. Immediate policy adoption of NMAREF ensures that the pandemic's lessons become catalysts for lasting transformation rather than precursors to decline.



Every level of government, from federal agencies to local boards, must view mathematics recovery as an educational and economic priority. By investing in diagnostic equity, teacher expertise, and culturally responsive pedagogy, the United States can rebuild a foundation of academic resilience and global competitiveness. NMAREF demonstrates that inclusive excellence and evidence-based reform are not competing goals they are mutually reinforcing imperatives.

Implementing this framework is, therefore, not only a matter of educational reform but one of national renewal.

## VIII. Conclusion

The **National Mathematics Achievement Recovery and Equity Framework** offers a comprehensive, data-informed, and culturally grounded response to one of the most significant educational crises in U.S. history. It bridges the divide between federal policy and classroom practice through structured diagnostics, teacher empowerment, and inclusive pedagogy.

Ma. Fe Dejeron's vision, grounded in more than a decade of direct teaching and curriculum leadership, reflects a professional and moral commitment to educational equity. Her endeavor exemplifies how informed educators can drive national reform—transforming individual classrooms into engines of systemic progress.

As states and districts seek long-term solutions to post-pandemic learning loss, NMAREF stands as both a blueprint for mathematics recovery and a testament to the enduring power of evidence, equity, and innovation in education.

## Author Note

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Ma. Fe Dejeron is a mathematics Intervention Specialist and educational innovator with over twelve years of experience designing and implementing student-centered learning frameworks across diverse educational contexts. She holds a Master of Arts in Special Education from Pacific Intercontinental College and a Bachelor of Secondary Education in Mathematics (Cum Laude) from Aklan State University. Her professional educator license (Illinois, Grades 9–12 Mathematics) and international credentials as a licensed teacher in the Philippines and Alberta, Canada, highlight her cross-cultural expertise and commitment to global standards of excellence in education.

Throughout her career, Ms. Dejeron has led initiatives in curriculum development, instructional coaching, and intervention program design, emphasizing data-driven equity and inclusive pedagogy. Her ongoing professional development—encompassing Title IX compliance, trauma-informed teaching, DEI training, and culturally responsive practices—has positioned her as a leader in bridging academic recovery with student well-being.





The *National Mathematics Achievement Recovery and Equity Framework (NMAREF)* represents Ms. Dejeron's professional endeavor to create a national model of educational resilience—one that equips teachers to transform data into equitable action, empowers students to regain confidence in mathematical reasoning, and enables schools to deliver measurable improvements in achievement and opportunity.

This white paper reflects her belief that educational reform must extend beyond technical solutions to embrace a moral vision of inclusion, excellence, and social responsibility. It is both a scholarly contribution and a practical roadmap for rebuilding America's educational future through evidence, empathy, and innovation.

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