

Unlocking Mathematical Potential: Integrating Equity, Executive Function, and Culturally Responsive Practices

EF+Math with the National Council of Teachers of Mathematics
05.23.2024

 **EF+Math Program**
supported by  aerdf



Agenda

- Welcome & Introductions
- EF+Math Program Overview
- Overview of Our Learning Approaches
- Executive Functions and Cultural Responsiveness
- Strategies for the Classroom
- Stay Connected with Us!
- Q&A

Who We Are

- **Dr. Bea Moore Luchin**, Executive Director, The Benjamin Banneker Association, Inc.
- **Melynee Naegele**, Instructional Coach, Osage County Interlocal Cooperative
- **Adam Smith**, Associate Director of Inclusive R&D Partnerships, EF+Math/AERDF



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NCTM Releases Position Statement on the Intersection of Culture and Math

Mathematics is not
culture neutral.



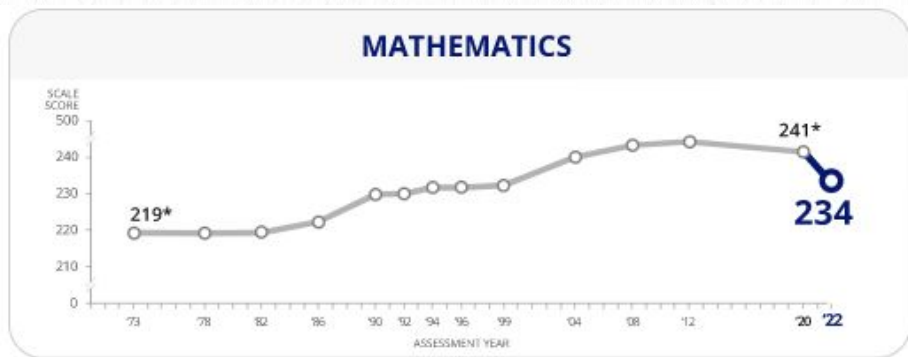
Effective mathematics
instruction leverages
cultural knowledge
and **lived experiences**
as **assets.**



EF+Math Program Overview



Math is a national challenge, amplified by the COVID-19 pandemic.



ROBERT GAUTHIER, LOS ANGELES TIMES, GETTY IMAGES

Student group	Mathematics		
	2020 Score	Change	2022 Score
American Indian/ Alaska Native	232	◆ -2	230
Asian	266	◆ -6	259
Black	225*	↓ 13	212
Hispanic	232*	↓ 8	223
Two or More Races	244	◆ -8	236
White	250*	↓ 5	244

- LEGEND**
- ◆ No significant change in 2022
 - ↓ Score decrease in 2022
 - # Rounds to zero.
 - * Significantly different ($p < .05$) from 2022.

NOTE: Results are not shown for Native Hawaiian/Other Pacific Islander students because reporting standards were not met.

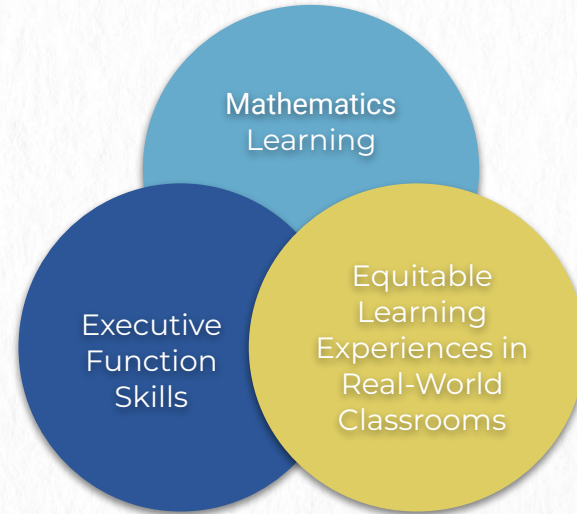
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2020 and 2022 Long-Term Trend (LTT) Reading and Mathematics Assessments.



We focus specifically on EF skills within the context of equitable mathematics learning approaches that .

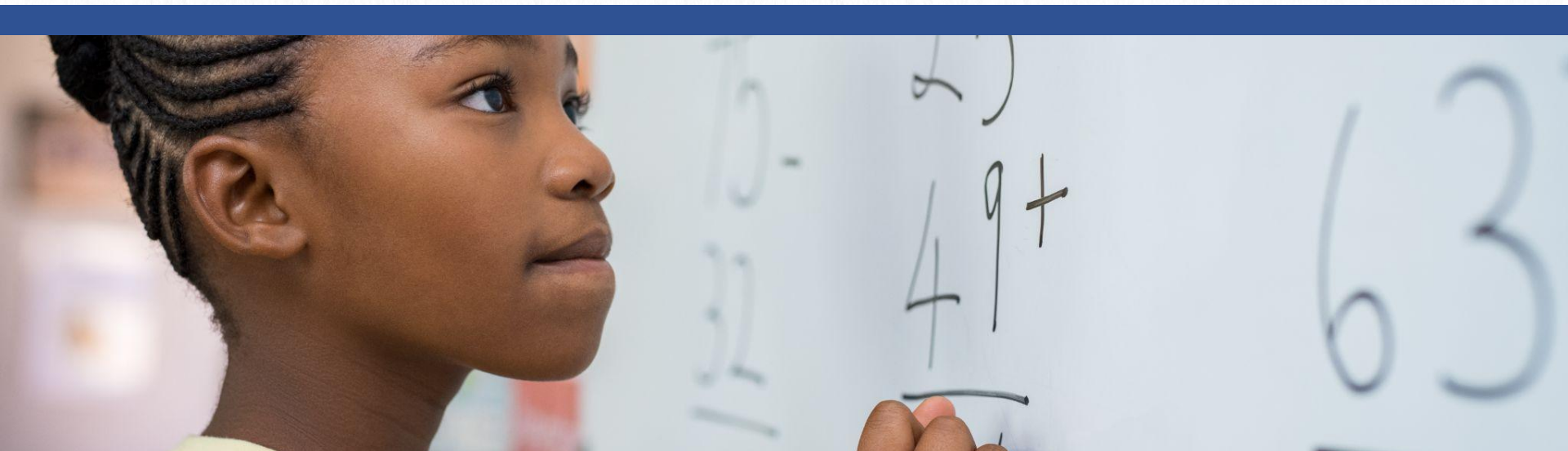
Our Core Hypothesis

The **integration of EF skill development** in math learning approaches that address **conceptual understanding and complex problem solving**, in ways which afford **equitable experiences in math** learning, can dramatically increase students' math outcomes.

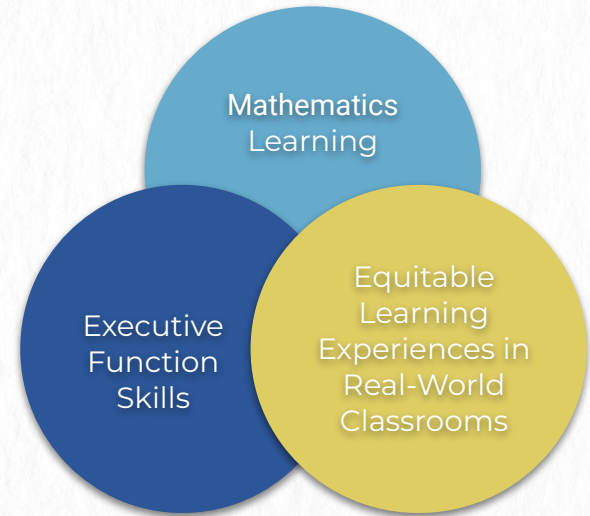
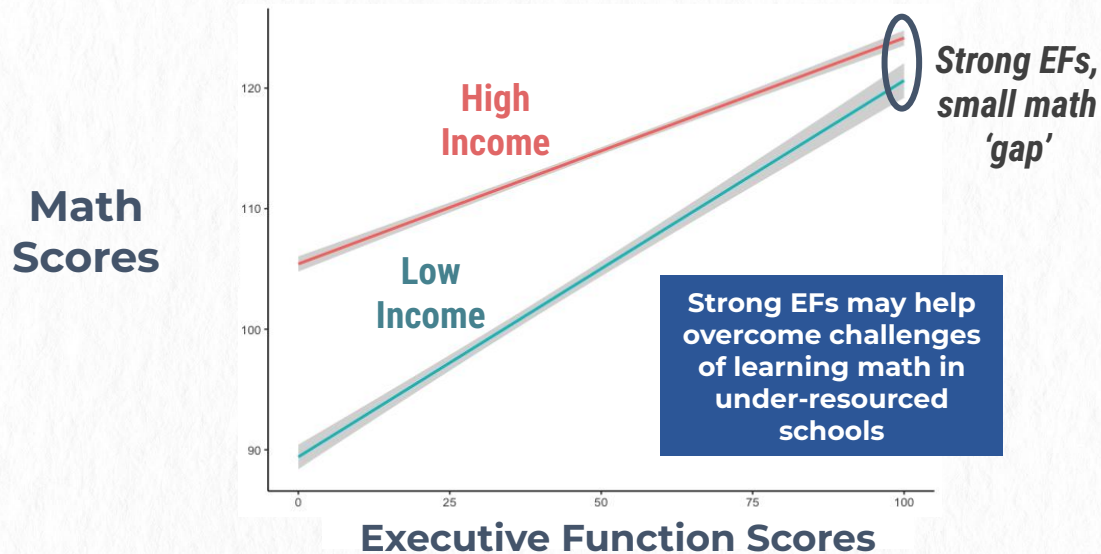


EF+Math Program Breakthrough Goal

Dramatically improve math outcomes for students in grades 3–8, with a focus on Black and Latinx students, and students of all races experiencing poverty, **by strengthening the core assets every student has — executive function (EF) skills.**




Why Focus on Executive Function Skills and Their Intersection with Math Learning and Equity?



Data from [National Center for Education Statistics](#)
 Early Childhood Longitudinal Program, 4th grade, N=7,615

Overview of Our Learning Approaches



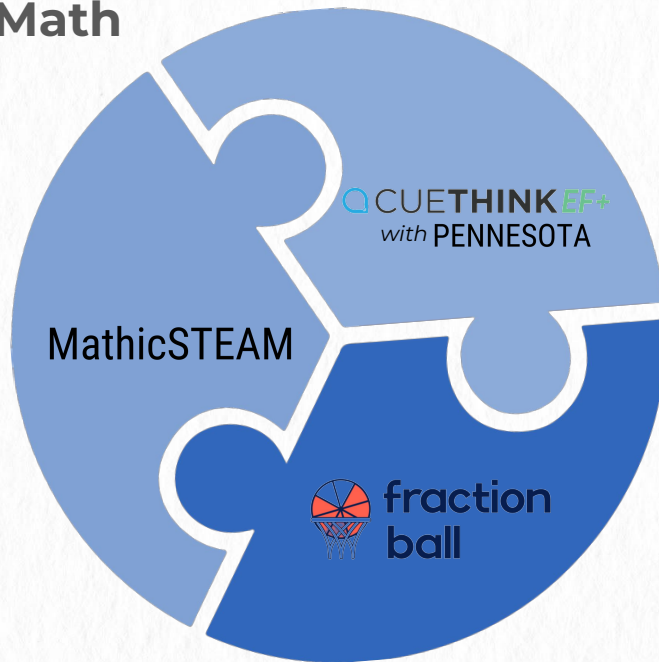


Multiple Promising Approaches to Math Integrated EF Intervention

● **Math fact fluency** development in **grades 4-5**

● **Direct EF building exercises** adapted to integrate into math contexts

● Developing **agency** through student-driven games with a mastery-orientation, and visual formative feedback



● Structured approach to complex **problem solving** in **grades 6-8**

● **Just-in-time EF and metacognitive supports** through embedded AI-driven learning detectors and probes to understand student behaviors and provide **personalized interventions**

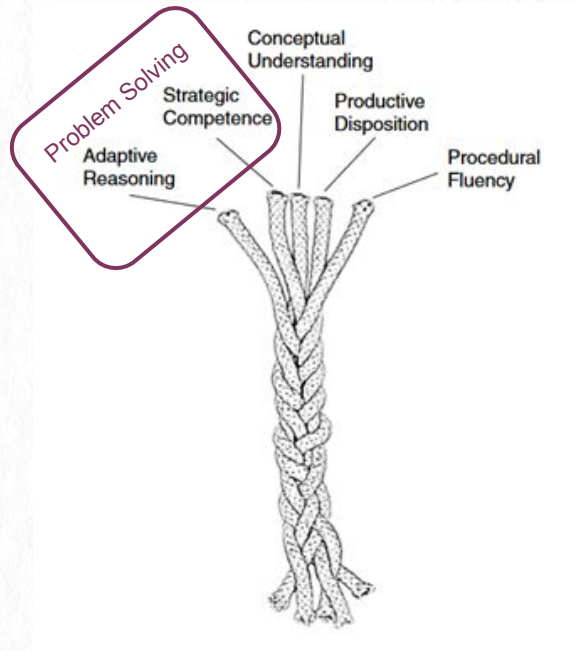
● Attending to **math identity and anxiety** through discourse practices, collaboration, and scaffolding

● Playful **embodied cognition** approach to **rational number understanding** in **grades 4-5**

● Opportunities to **adaptively monitor, plan, update, and shift thinking** within reasoning about rational numbers in basketball games and strategies

● Improving **math-related emotions** and teamwork through collaborative learning

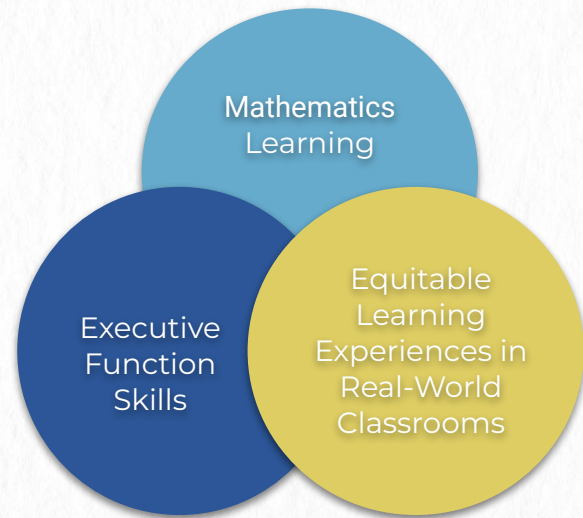
Why Conceptual Understanding & Complex Problem Solving?



- Conceptual understanding and complex problem solving skills play a crucial role in mathematical proficiency
- Learning science has uncovered specific approaches most effective for improving conceptual understanding
- Developing conceptual understanding goes hand in hand with developing EF skills

Our Connection to NCTM's Position Statement

- **Mathematics is not culture neutral.**
- **Effective mathematics instruction leverages cultural knowledge and lived experiences as assets.**
- **Effective mathematics teachers are culturally conscious.**
- **Effective schools develop systemic approaches that embrace culturally relevant mathematics instruction**

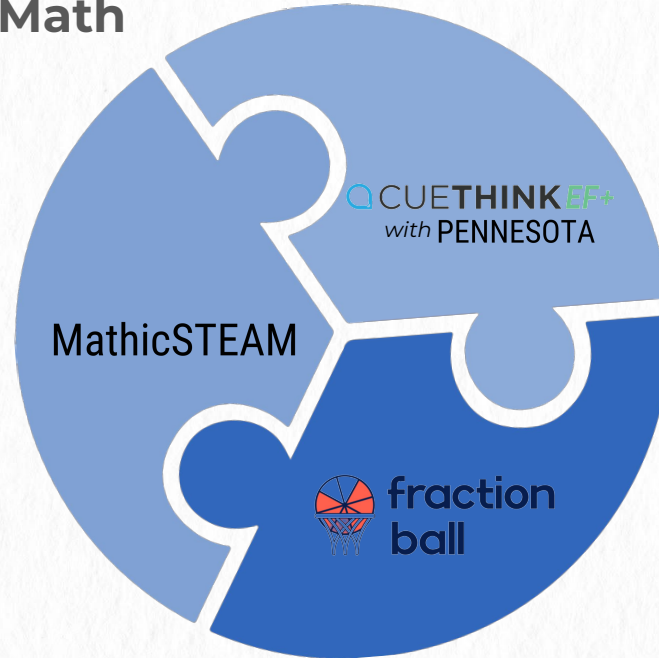


Executive Functions and Cultural Responsiveness





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Giving Math Cultural Meaning



Core Concepts: Math Instruction for Equity

- Math lessons must be planned to include opportunities for all students to develop and advance their **metacognition** and **communication skills**
- To promote equity, instructors should ask math questions using both **formal and informal wording** to help students understand and explain the underlying concepts in **multiple ways**
- Good **formative assessment** strategies can give educators insights into students' thinking beyond rote memorization and regurgitation

Strategies for the Classroom



Strategies for the Classroom

Mindsets

Do I recognize the **power** of attending to my students' assets through designing learning experiences that promote these assets?

Executive Functions

Strategies

How can I **design** learning experiences for students that celebrate their assets and promote their inherent brilliance?

Beliefs

Do I **believe** in my students' inherent mathematical brilliance, despite systems and structures that might suggest otherwise?

Beliefs

Do I **believe** in my students' inherent mathematical brilliance, despite systems and structures that might suggest otherwise?

Cultural Responsiveness as Commitment

- Culturally Responsive Teaching should foster civic engagement and promote activism that engages the student at high levels.
- **This requires meaningful contexts, on-level content and attention to a learning environment that continues to promote equity and access.**
- The implementation of this type of instruction includes the desire to change the education narrative from one of failure and empathy to success and achievement.

A Culturally Responsive curriculum should facilitate students' critical examination of the world and critical consumption of information and engage the larger community beyond the classroom walls.

Teachers must have access to high quality curriculum materials and appropriate professional development that will support the creation of learning spaces that are culturally significant.

The attention to and inclusion of pedagogy (how), content (what) and equity (who) should manifest itself in all professional development and instructional delivery systems



Mindsets

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EFs as Inherent Assets

*Despite structural inequities that perpetuate math performance differences, **every child** possesses **foundational assets** that enable them to learn what they deem important to learn. One set of skills associated with success in mathematics is executive functioning (EF) ability. EFs are thought to include three separable, yet interacting processes, often referred to as **cognitive flexibility**, **working memory**, and **inhibitory/attentional control** (Miyake et al., 2000).*

EF+MATH program

Executive Functions,
Mathematics, and Equity:
A Primer

1. I can make sense of problems and persevere in solving them.

a. Cognitive Flexibility

- i. explain to themselves the meaning of a problem
- ii. consider comparable problems
- iii. monitor and evaluate progress and change course if necessary
- iv. understand the approaches of others to solving complex problems and identify correspondences between different approaches

b. Inhibitory Control

- i. plan a solution pathway rather than simply jumping into a solution attempt
- ii. monitor and evaluate progress and change course if necessary
- iii. understand the approaches of others to solving complex problems and identify correspondences between different approaches

c. Working Memory

- i. make conjectures about the form and meaning of the solution
- ii. plan a solution pathway rather than simply jumping into a solution attempt
- iii. consider comparable problems
- iv. try special cases and simpler forms of the original problem in order to gain insight into its solution

When thinking about your learners, how might your team crosswalk the standards for math practices and the executive function skills of Cognitive Flexibility, Inhibitory Control and Working Memory?

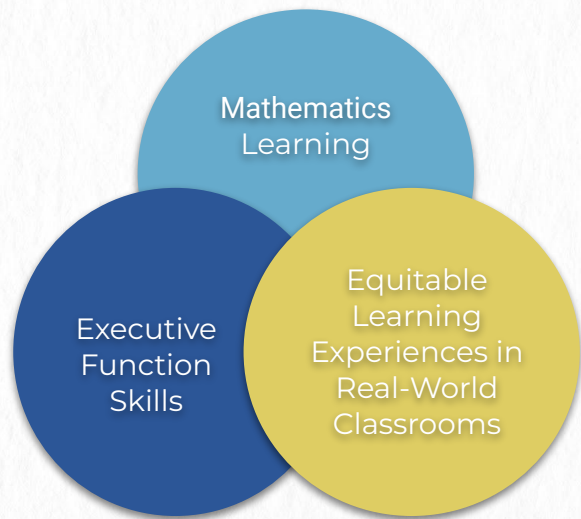
- 1. I can make sense of problems and persevere in solving them.**
- 2. I can reason abstractly and quantitatively**
- 3. I can construct viable arguments and critique the reasoning of others.**
- 4. I can model with mathematics.**
- 5. I can use appropriate tools strategically.**
- 6. I can attend to precision.**
- 7. I can look for and make use of structure.**
- 8. I can look for and express regularity in repeated reasoning.**

Strategies

How can I **design** learning experiences for students that celebrate their asset and promote their inherent brilliance?

Strategies / Resources

- **Examine opportunities** to engage students in designing meaningful and culturally connected learning experiences in your classroom.
- **Explicitly attend** to EF skill development by leveraging them through the SMPs.
- **Maximize moments** for students to deepen their conceptual understanding through rich, complex, and non-routine tasks.



Stay Connected with Us!

 **EF+Math Program**
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How to get involved with our work:

- **District partnerships**

Inclusive Evaluation in partnership with the American Institutes for Research (AIR)

- **Free access** to supplemental materials and teacher training for 2024-2025
- Opportunities to **participate** in an **educator advisory board** to guide research strategy and cointerpret study results and findings
- **Compensation** for teachers and district staff for time spent on study activities

- **Stay informed about findings & future opportunities**

- Join our email list!

- **Sneak Peek: AERDF's National Inclusive R&D Ecosystem Coming Soon!**



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 to partner with
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 up for our email
 list!**

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