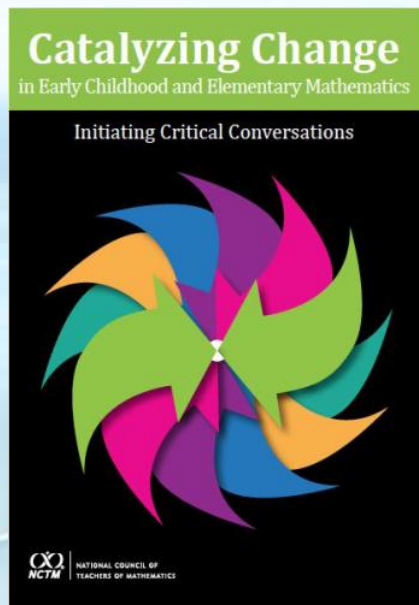




Catalyzing Change

Overview of the 4 Key Recommendations for Early Childhood & Elementary Mathematics



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NCTM 100 Days of Professional Learning
Wednesday, May 27, 2020



Writing Team

Catalyzing Change in Early Childhood and Elementary Mathematics: Initiating Critical Conversations



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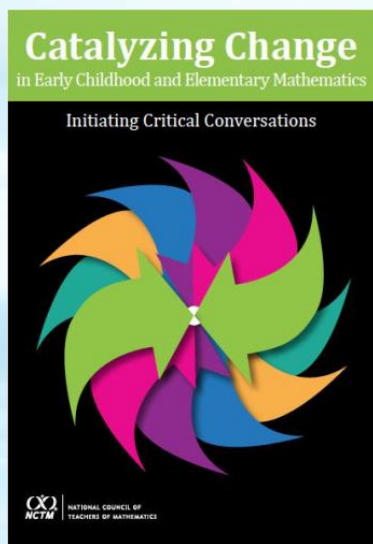
Agenda

- **Why catalyze change?**
- **Examine the four key recommendations.**
- **Consider next steps.**
- **Questions?**

Throughout the Session
Enter comments and
questions in the chat.
Pose questions to the panel
directly in the Q&A.

Catalyzing Change Series

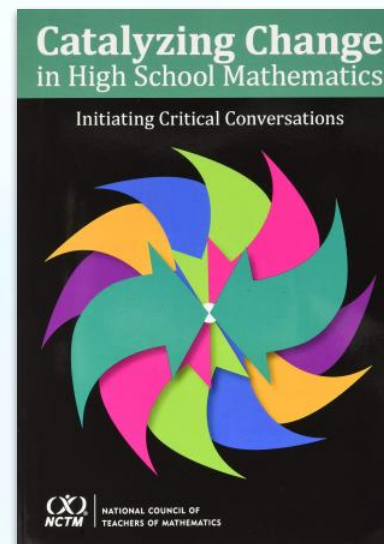
Official Positions of the National Council of Teachers of Mathematics



NCTM 2020



NCTM 2020



NCTM 2018

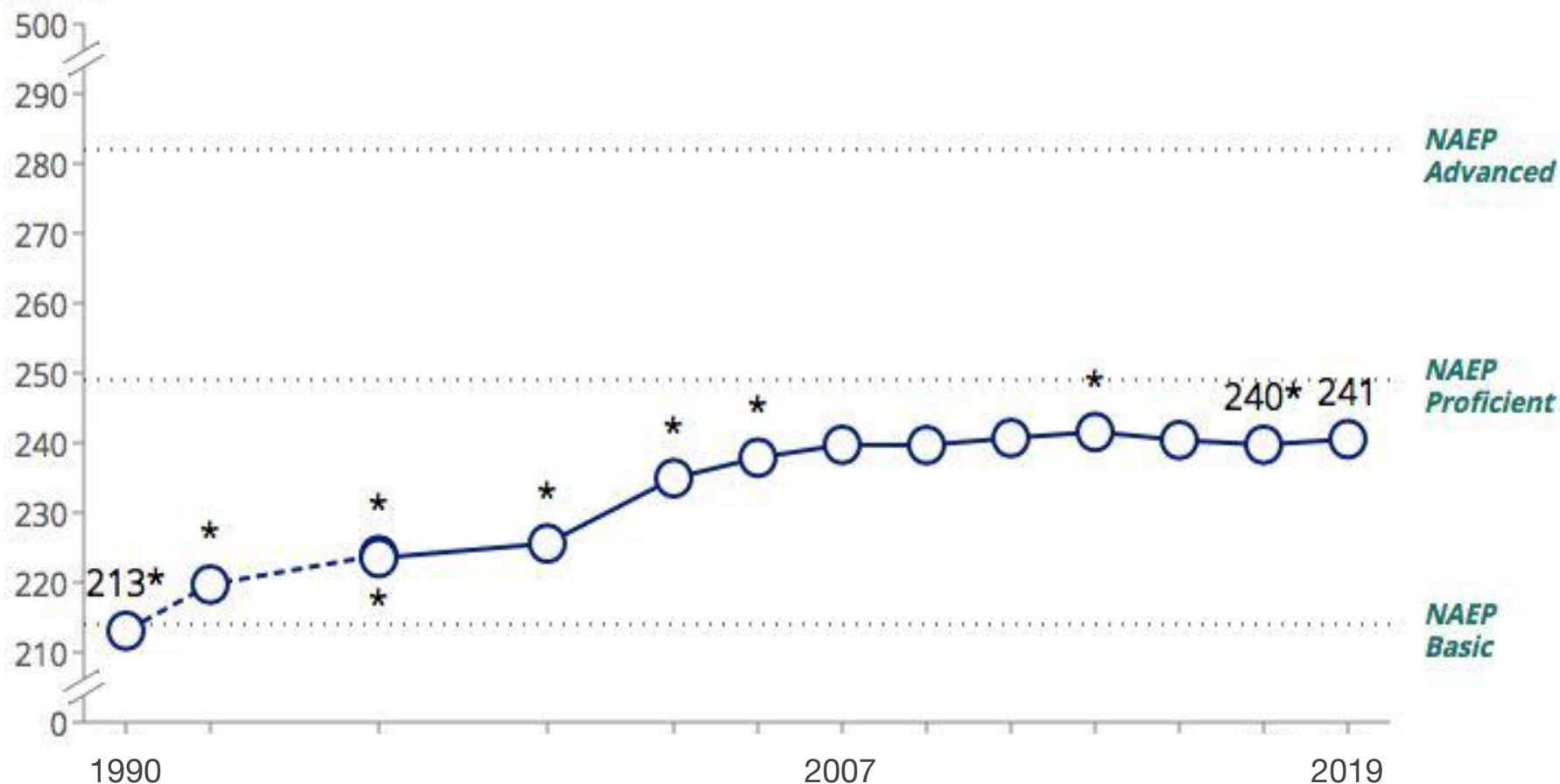
What are some critical issues at the early childhood and elementary levels that are hindering children's mathematical success?



Please share in the chat.

Why Catalyze Change

Grade 4 Mathematics Achievement, 1990 - 2019

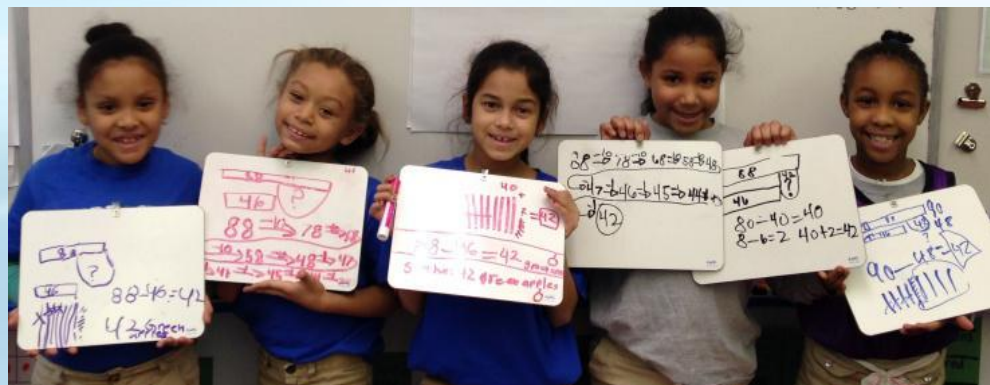


Why Catalyze Change

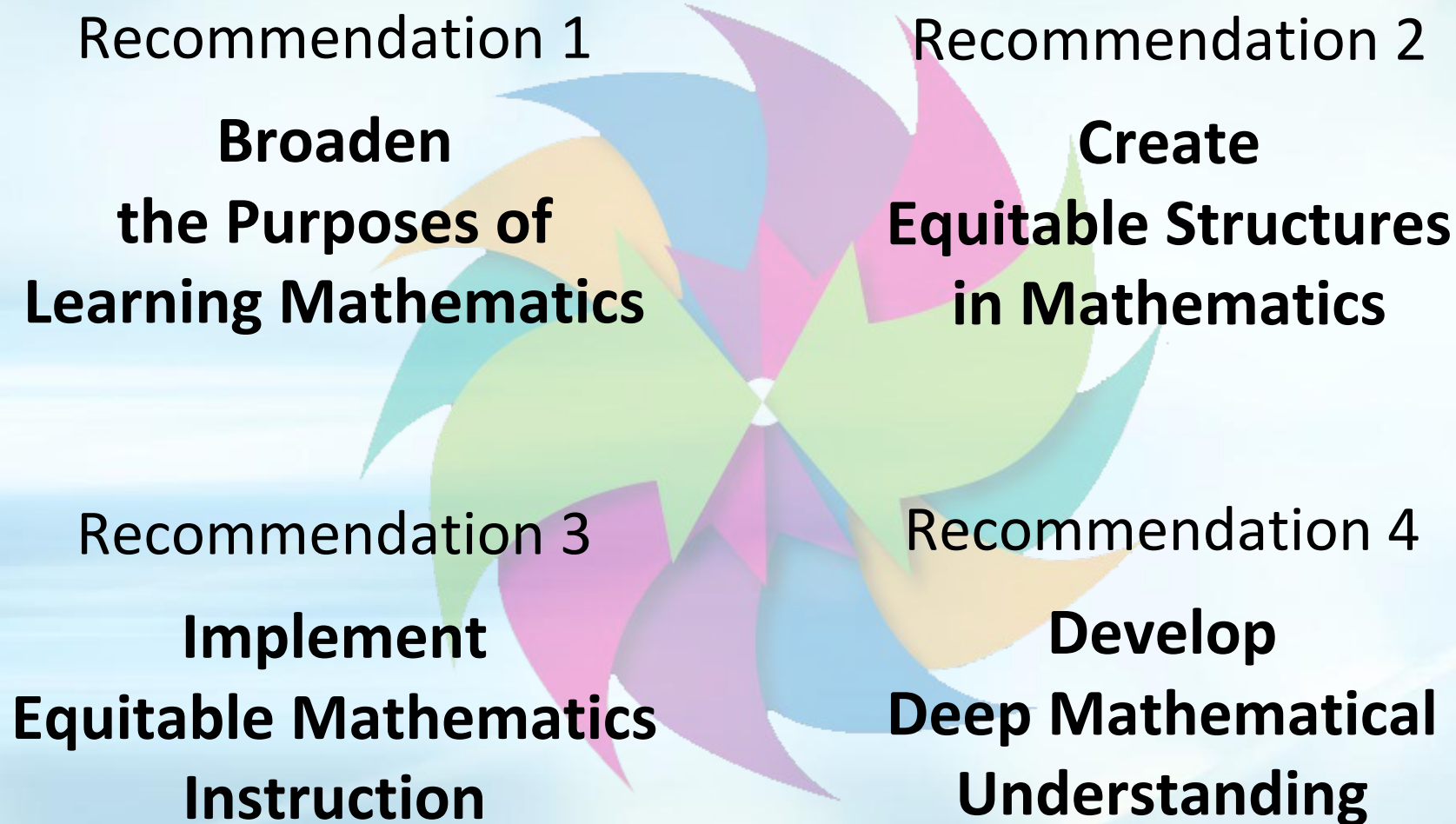
We are challenged that *children's mathematics experiences are of uneven quality* at every level.

Disparities exist within individual classrooms, across grade levels within schools, and across schools within districts.

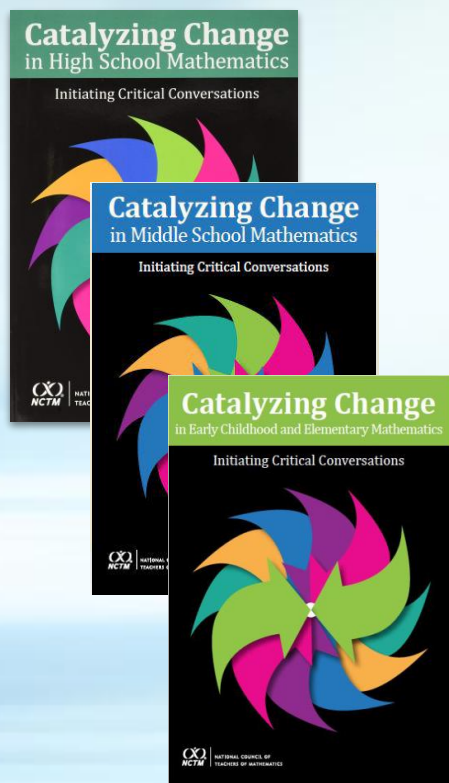
We have the capacity to create the change needed so that each and every child can access *mathematically powerful learning environments*.



(NCTM 2020, p. 1)



Recommendations Across the Grade Bands



	Early Childhood and Elementary	Middle School	High School
Broaden the Purposes of Learning Mathematics	Each and every child should develop deep mathematical understanding as confident and capable learners; understand and critique the world through mathematics; and experience the wonder, joy, and beauty of mathematics.	Each and every student should develop deep mathematical understanding, understand and critique the world through mathematics, and experience the wonder, joy, and beauty of mathematics, which all contribute to a positive mathematical identity.	Each and every student should learn the Essential Concepts in order to expand professional opportunities, understand and critique the world, and experience the wonder, joy, and beauty of mathematics.
Create Equitable Structures in Mathematics	Early childhood and elementary mathematics should dismantle inequitable structures, including ability grouping and tracking, and challenge spaces of marginality and privilege.	Middle school mathematics should dismantle inequitable structures, including tracking teachers as well as the practice of ability grouping and tracking students into qualitatively different courses.	High school mathematics should discontinue the practice of tracking teachers as well as the practice of tracking students into qualitatively different or dead-end course pathways.
Implement Equitable Mathematics Instruction	Mathematics instruction should be consistent with research-informed and equitable teaching practices that nurture children's positive mathematical identities and strong sense of agency.	Mathematics instruction should be consistent with research-informed and equitable teaching practices that foster students' positive mathematical identities and strong sense of agency.	Classroom instruction should be consistent with research-informed and equitable teaching practices.
Develop Deep Mathematical Understanding	Early childhood settings and elementary schools should build a strong foundation of deep mathematical understanding, emphasize reasoning and sense-making, and ensure the highest-quality mathematics education for each and every child.	Middle schools should offer a common shared pathway grounded in the use of mathematical practices and processes to coherently develop deep mathematical understanding, ensuring the highest-quality mathematics education for each and every student.	High schools should offer continuous four-year mathematics pathways with all students studying mathematics each year, including two to three years of mathematics in a common shared pathway focusing on the Essential Concepts, to ensure the highest-quality mathematics education for all students.

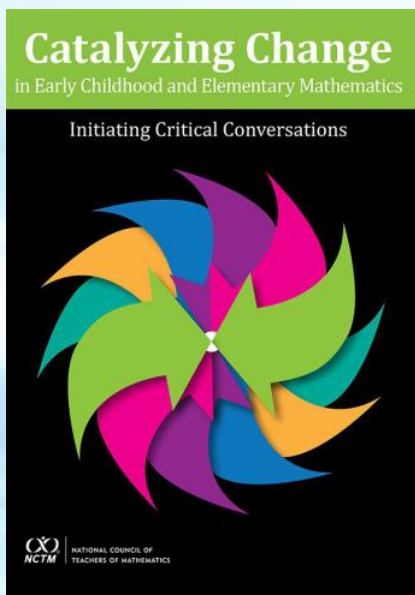
Recommendation 1

Broaden the Purposes of Learning Mathematics



Recommendation 1

Broaden the Purposes of Learning Mathematics



Each and every child should :

- develop deep mathematical understanding as confident and capable learners;
- understand and critique the world through mathematics; and
- experience the wonder, joy, and beauty of mathematics.

Recommendation 1

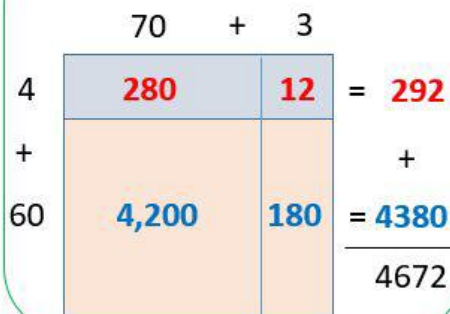
Broaden the Purposes of Learning Mathematics

Develop deep mathematical understanding as confident and capable learners

Use mathematics as a lens to understand, critique, and create solutions for the world



Area Model



Experience wonder, joy, and beauty in mathematics



Multiple Purposes of Learning Mathematics

“The power of the multiple purposes occurs when the purposes converge in ways that **foster positive relationships between children and mathematics.**”

The goal is for children to see themselves in the world of mathematics, not looking in from the perimeter or looking for the nearest exit door.”



Recommendation 2

Create Equitable Structures

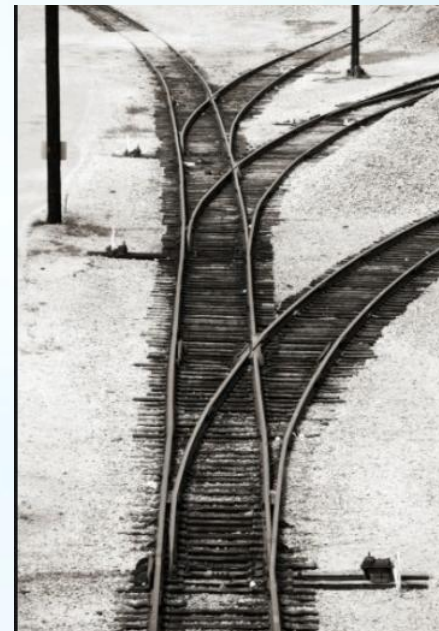




“Just, equitable, and inclusive learning opportunities for all students **demand change** in institutional **structures**, teaching, and learning **environments**, and individual **beliefs** and **actions**.”

Catalyzing Change in Early Childhood and Elementary Mathematics (NCTM 2020, p. 25)

Ability grouping and tracking of children lead to differential learning opportunities that not only **widen achievement gaps** but **impact how children see themselves** in relationship to learning - their identity, self-confidence, motivation toward mathematics.



Stop and Reflect:

What does ability grouping and tracking look like in early childhood and elementary school settings?

Ability grouping and Tracking

Between-class grouping: students placed into high, average, or low classes based on test performance or prior achievement

Within-class grouping: teacher assign students using pre-assessment or diagnostic tests into sub-groups within the classroom based on perceived ability

Tracking institutionalized a fixed mindset about children and their abilities to learn mathematics that shape the type of mathematical experiences children receive in school.

Beliefs about Children's Mathematical Abilities

Unproductive Beliefs

Labeling children allows teachers to identify remediation and provide targeted intervention toward getting “atypical” learners to be at “typical” performance.

Productive Beliefs

Labels constrain children's learning opportunities. The labels assigned shape teachers' decision-making, determine children's access to high-quality rigorous mathematical experiences, and affects how children see themselves as doers of mathematics.



Beliefs about Children's Mathematical Abilities

Unproductive Beliefs

Individualized curriculum and support or ability groupings are the **only ways to tailor the content and pace** of instruction to children's varying levels of performance.

Productive Beliefs

Curriculum and instruction should **account for and leverage human difference** to promote rich and connected mathematics learning experiences. **A common shared mathematics learning experience benefits all children.**



Beliefs about Children's Mathematical Abilities

Unproductive Beliefs

Remediation is required to move children toward “grade level” mathematics.

Productive Beliefs

All children should have access to grade-level content centered on learning mathematics with understanding, **actively building new knowledge from their informal experiences and prior knowledge.**

Beliefs about Children's Mathematical Abilities

Unproductive Beliefs

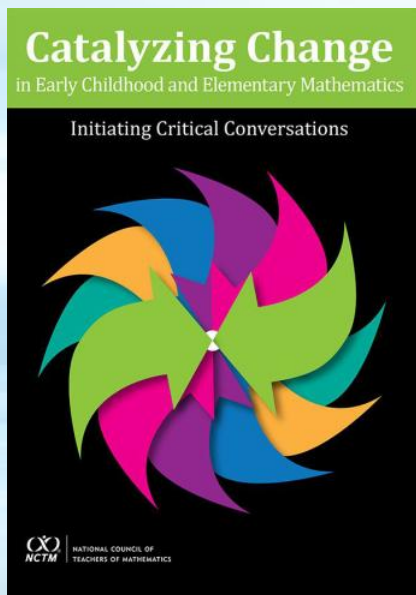
Interventions must focus on basic facts and skills; children must master the basics prior to engaging with complex problem solving.

Productive Beliefs

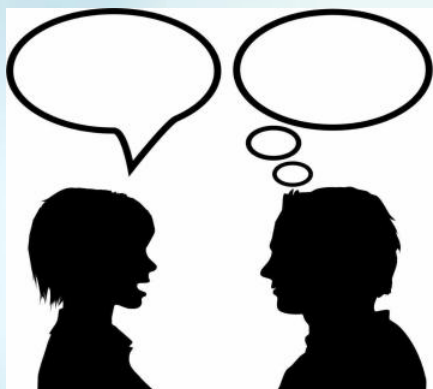
Interventions must focus on content connected with and promotes grade-level curriculum through problem solving and reasoning and not review of low-level facts or procedural skills.

Recommendation 2

Create Equitable Structures in Mathematics



Early childhood and elementary mathematics must dismantle inequitable structures, including ability grouping and tracking, and challenge spaces of marginality and privilege.



Please share in the chat!

What work must occur to serve all children well and stop perpetuating privilege and marginalization of specific student groups in mathematics?

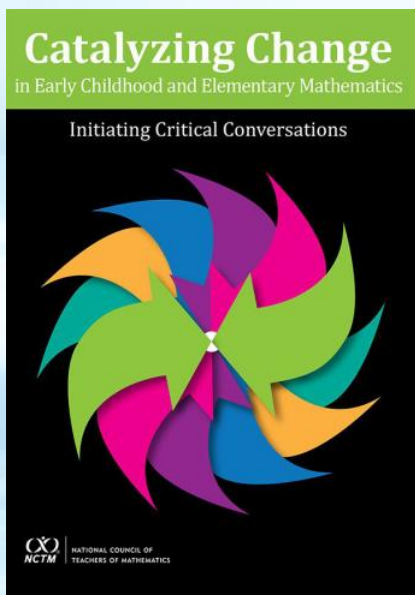
Recommendation 3

Implement Equitable Instruction



Recommendation 3

Implement Equitable Mathematics Instruction



Mathematics instruction should be consistent with research-informed and equitable teaching practices that nurture children's positive mathematical identities and strong sense of agency.

Why Focus on Identity and Agency?

How strongly a child identifies with being a *doer* of mathematics predicts their achievement, interest, and persistence in mathematics (Boaler, 2015; Cvencek, Kapur, and Meltzoff, 2015; Lee, 2012).

Stop and Reflect:

- Do your students see themselves as mathematically capable?
- Do all teachers in your school see all students as *doers* of mathematics?



2ND GRADE MATHEMATICIANS SPEAK OUT AGAINST STEREOTYPES!



WE BELIEVE...

women can do math. anybody
can do math because every-
one is a mathematician.

Identity & Agency in the Mathematics Classroom

Children's Mathematical Identity

The dispositions and deeply held beliefs that students develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in powerful ways across the contexts of their lives (Aguirre, Mayfield-Ingram, and Martin, 2013, p. 14).



Children's Mathematical Agency

The learner's confidence in their own knowledge, which “embraces the learner as an active agent working upon the world, rather than passive recipient” (Lawler, 2012, p. 167).

Teacher's Mathematical Identity

How teachers see themselves as doers of mathematics as well as how they take up their role as mathematics teachers of children.

Teacher's Mathematical Identity

Teachers' professional identities, their “sense of self as well as their knowledge, beliefs, interests, dispositions, and orientations toward their work,” are ever evolving as they learn and experience mathematics each time they work with their students (Drake, Spillane, and Hufferd-Ackles 2001, p. 2).

What do you do when you make a mathematical mistake in front of your students?

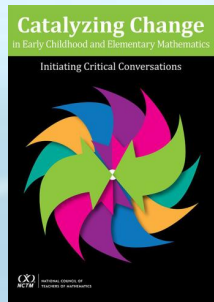
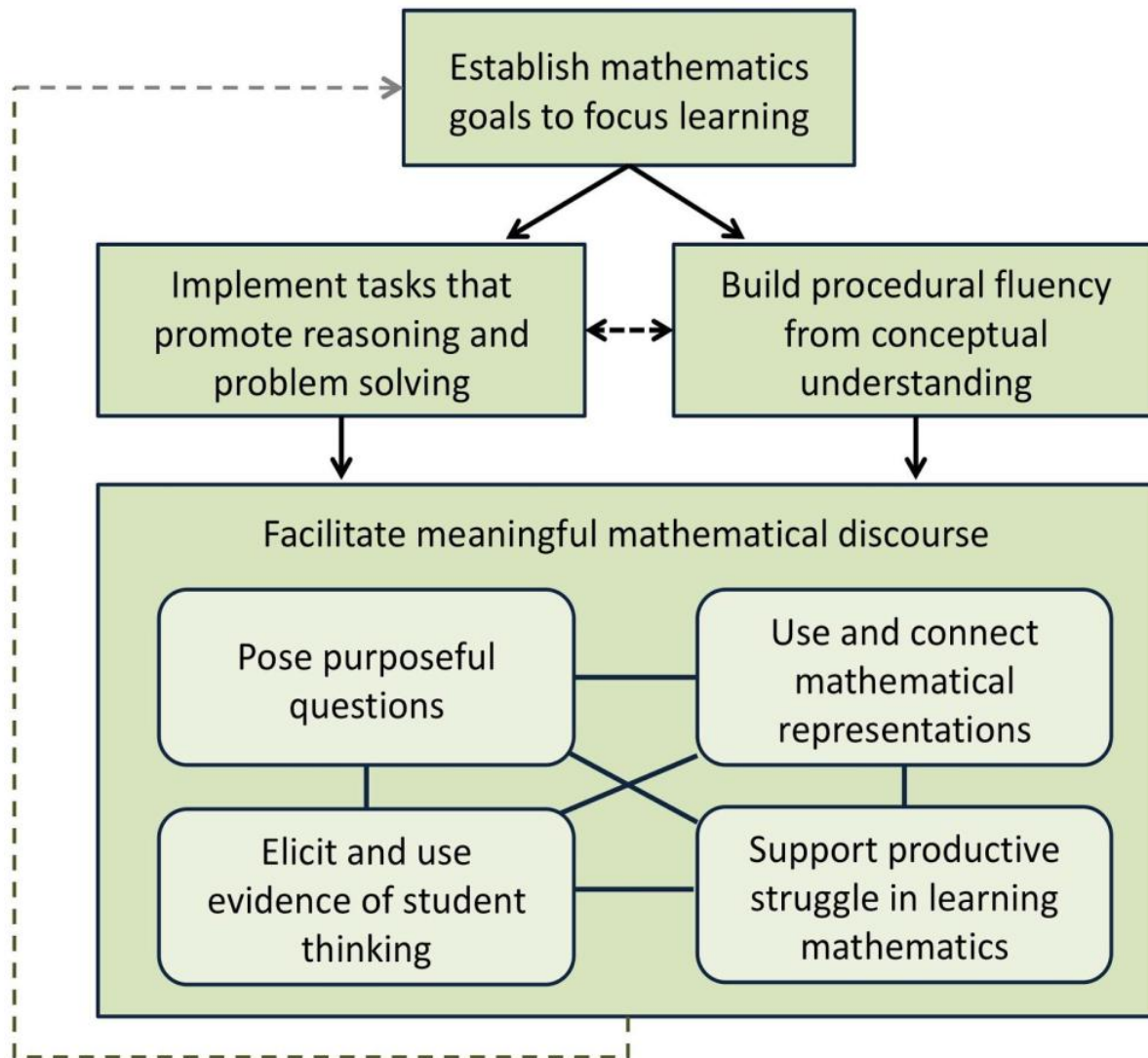
What experiences have you had with mathematics and how have those shaped your disposition?

How do you respond when a student asks a math question that you don't know how to answer?

Nurture Children's Positive Mathematical Identities and Strong Sense of Agency



High-leverage, effective mathematics teaching practices



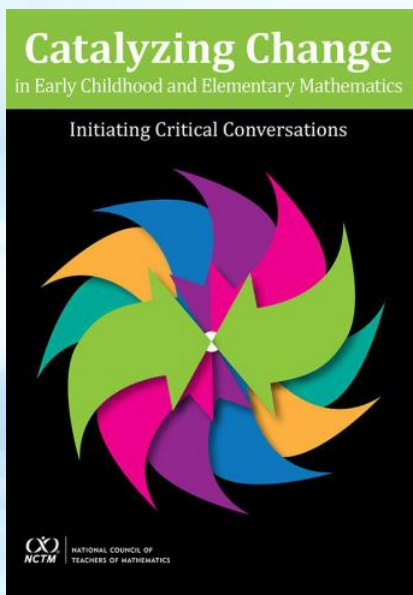
Recommendation 4

Develop Deep Mathematical Understanding



Recommendation 4

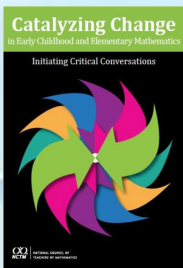
Develop Deep Mathematical Understanding



Early childhood settings and elementary schools should build a **strong foundation of deep mathematical understanding**, emphasize **reasoning** and **sense making**, and ensure the highest-quality mathematics education **for each and every child**.



**“When mathematics instruction goes deep,
children are empowered to explore the richness
of the mathematical landscape.”**

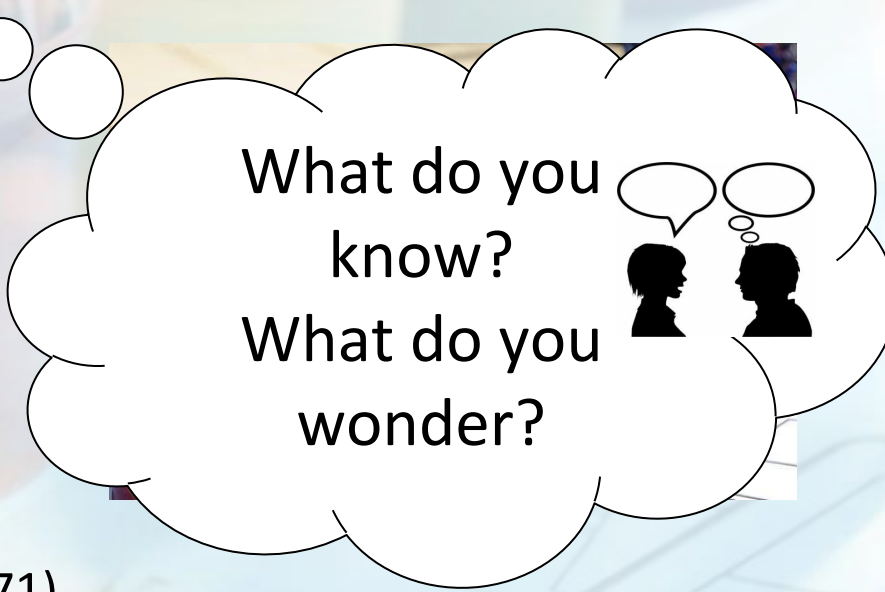


Catalyzing Change in Early Childhood and Elementary Mathematics
(NCTM 2020, p. 77)

The Crayon Task

Marcus picks up materials for his group. He grabbed a handful of crayons to share. Some of the crayons were green and some of the crayons were gray.

Ms. Phillips noticed Marcus had 9 crayons and more green than gray.



What do you know?
What do you wonder?

Catalyzing Change in Early Childhood and Elementary Mathematics (NCTM 2020, p. 71)

The Crayon Task

Know	Wonder
<ol style="list-style-type: none">1. 9 total crayons2. Only green and gray crayons3. More green than gray crayons.	<ol style="list-style-type: none">1. How many green crayons? Gray crayons?2. Is there more than one answer?3. How many more green crayons than gray?

Catalyzing Change in Early Childhood and Elementary Mathematics (NCTM 2020, p. 71)

Children as *Doers* of Mathematics

Engaging children actively as

- ***authors*** of their mathematical thinking.
- ***generators*** of strategies.
- ***sharers*** of mathematical insights.

Children as *Knowers* and *Sense Makers* of Mathematics

Engaging children actively as

- ***constructors*** of their understanding.
- flexible ***thinkers*** building on and seeking connections among mathematical ideas.

Mathematical Processes and Practices

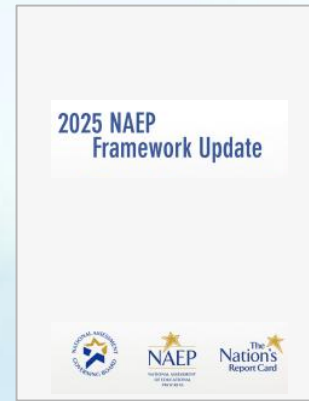
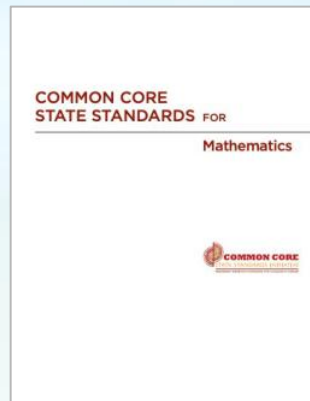
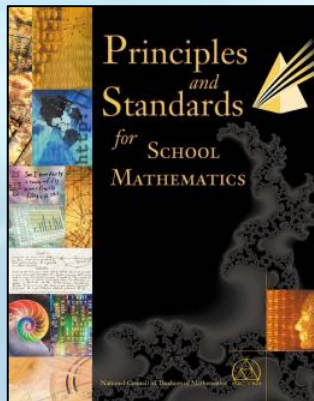
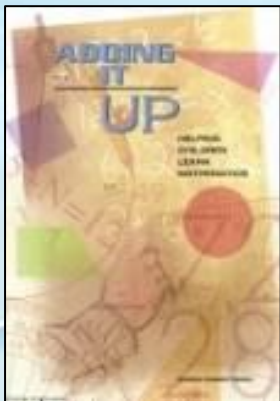
Children as *Doers* of Mathematics

**Strands of
Mathematical
Proficiency**
(NRC 2001)

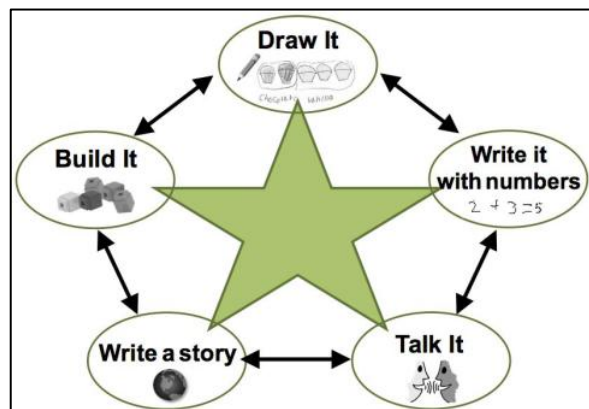
**Standards for
Mathematical
Processes**
(NCTM 2000)

**Standards for
Mathematical
Practice**
(NGA Center &
CCSSO 2010)

**2025 NAEP
Framework
Mathematical
Practices**
(NAGB 2020)



Representing and Connecting



Contextualizing and Decontextualizing

Contextualize ↔ Decontextualize

9 green and gray crayons with more green than gray.

$\square + \square = 9$

Interrelated Practices & Processes for Early Childhood and Elementary Mathematics

Explaining and Justifying

"6 green and 3 gray crayons. It works because it has more green than gray."

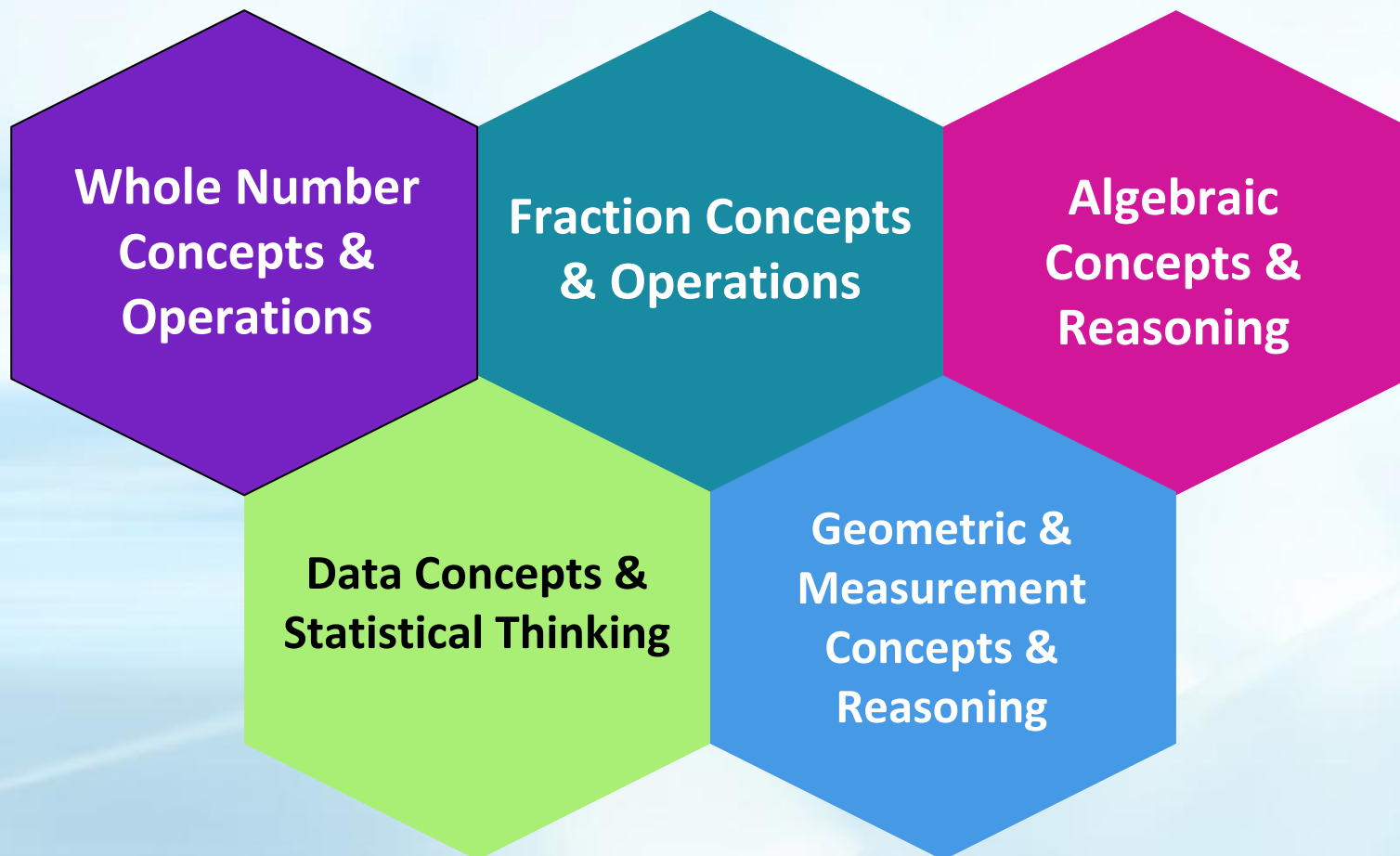
"I tried trading again, and got 4 green and 5 gray. Too many gray, so it doesn't work."

Noticing and Using Mathematical Structures

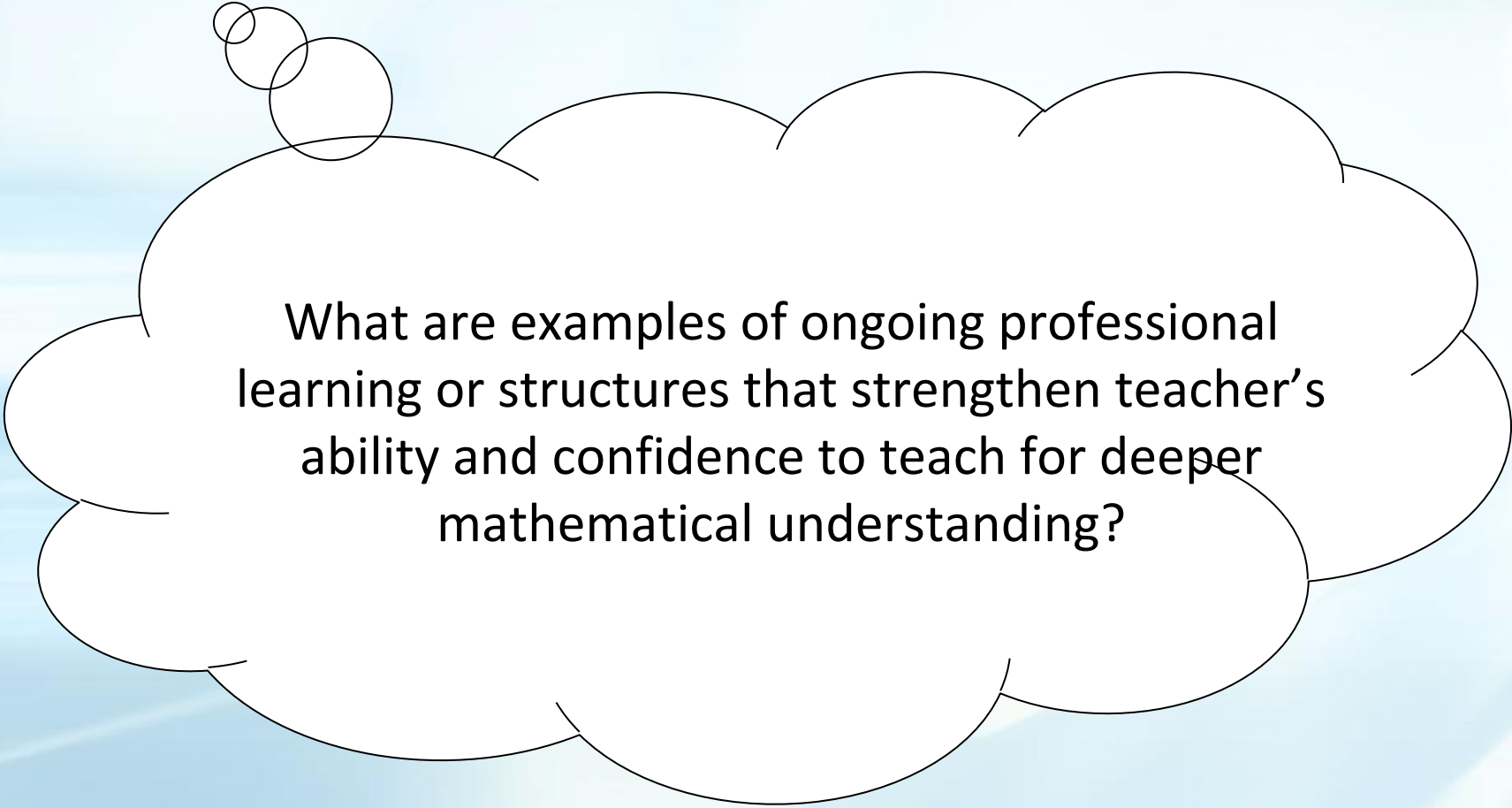
$8 + 1$	"I started with 8 green and 1 gray. Then I traded a green tile for a gray each time."
$\downarrow \uparrow$	
$7 + 2$	
$\downarrow \uparrow$	
$6 + 3$	
$\downarrow \uparrow$	
$5 + 4$	

Mathematical Content

Children as *Knowers* and *Sense Makers* of Mathematics



Stop and Reflect



What are examples of ongoing professional learning or structures that strengthen teacher's ability and confidence to teach for deeper mathematical understanding?



Next Steps

Initiating Critical Conversations & Actions



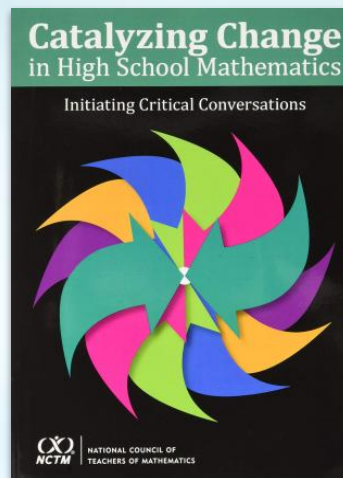
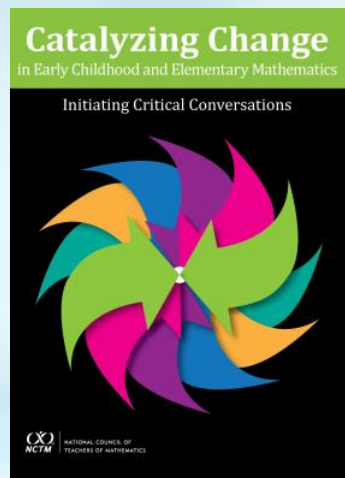
Make a commitment to action!



Post an initial step in the chat as a catalyst for change in early childhood and elementary mathematics.



Tweet and prompt other stakeholders to join us in these needed critical conversations. #nctmchange



Books and Resource Guides

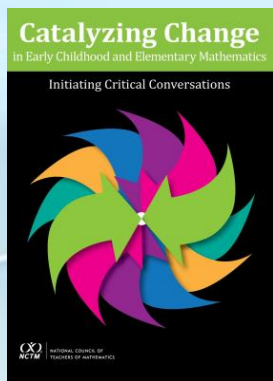
<https://www.nctm.org/change/>

- Ordering information
- Print and ebook versions
- Book study guide
- Webinars
- Resources and more



Closing Comment

“It is our responsibility to launch every child on their mathematical journey with confidence in themselves as knowers, doers, and sense makers of mathematics and with the realization that ***each and every person belongs in mathematics.***”



Catalyzing Change in Early Childhood and Elementary Mathematics
(NCTM, 2000, p. 128)

Questions





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TEACHERS OF MATHEMATICS
CELEBRATING 100 YEARS

#nctmchange
www.nctm.org/change

Thank You

<https://www.nctm.org/change/>

