

Teaching and Learning Mathematics

Transforming Challenges into
Opportunities to Move Forward

Trena L. Wilkerson

NCTM President

Baylor University

Presented at the

New Hampshire Teachers of Mathematics

Afterschool Virtual Conference 2021



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@TrenaWilkerson
@NCTM

Who is NHTM?

#nctmchange

...provide vision and leadership in improving the teaching and learning of mathematics so that each student is ensured quality mathematics education and each teacher of mathematics is ensured the opportunity to grow professionally.

Provides:

- Leadership
- Professional Development
- PST Scholarships
- Recognition through awards & certificates
- Supports NCTM's MET



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<https://nhtm.wildapricot.org/>

NCTM

- **NCTM's Mission:** The National Council of Teachers of Mathematics advocates for high-quality mathematics teaching and learning for **each and every** student.
- **NCTM's Strategic Framework:**
 - Teaching & Learning
 - Access, Equity & Empowerment
 - Building Member Value
 - Advocacy



Session Overview

- Explore new challenges and new learnings related to teaching and learning mathematics
- Brief overview of NCTM's *Catalyzing Change* recommendations
- Discussions & Sharing: Consider challenges, opportunities and new learnings
- Actions & Next Steps



Let's 'JAM' BOARD

What is an effective way you have found to empower and engage students in mathematics during this pandemic time?



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What is an effective way you have found to empower and engage students in mathematics during this pandemic time?

Kami App

Telling the kids that if their cameras are off, I will probably call on them!

Desmos Activities

Jamboard

Whiteboard.fi

Games

GeoGebra

Emphasizing use of Number Talks

jamboards

Interactive Google Slides

Desmos

Brainiaccamp

Problem Solving

Nearpod

Step out of my comfort zone and focus on the student led instruction

Pear Deck

Manipulatives

Using the interactive templates from Theresa Wills in Google Sheets.

One-on-One zoom help

Constantly calling on kids

Boom Cards

Wakelet

Increased flexibility

Task Cards and Nearpod

Deltamath

Professional development

Pixel Art

Kami Wacom . Hands-On Equation . Schoology

jamboard, desmos, geoboard

Delta Math!

Boom cards and blooket

Vritual Manipulatives

Discussion prompts & breakout rooms

Kahoot

Desmos Teacher

GoFormative



Opportunities & Challenges

Pandemic Innovations Worth Keeping

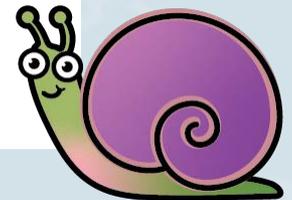
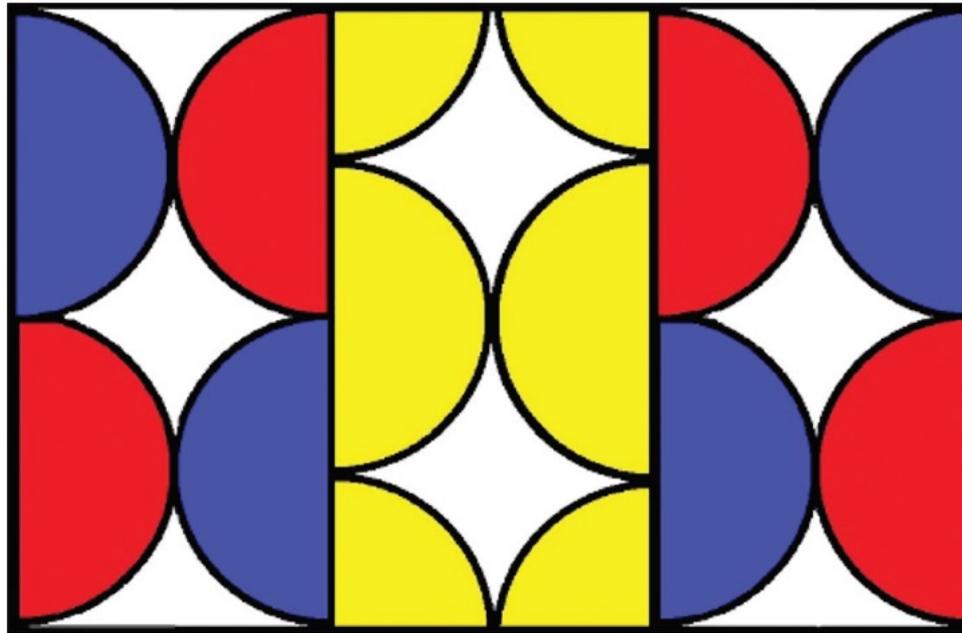
- New ways to communicate mathematically
 - Collaboration & classroom culture
- Focused curriculum and content
- New approaches to making-grade level ideas accessible
- Engaging Students in a variety of ways
 - Dealing with distractions in home life
 - Cultural connections
- Working with parents in new ways
- Care: self, students, colleagues, family, others



What do you notice? What do you wonder



Problems to Ponder, December 2020 MTLT, p. 1049



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Baylor University
SCHOOL OF EDUCATION
Department of Curriculum & Instruction

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

Creating a Positive Classroom Culture Through Discourse

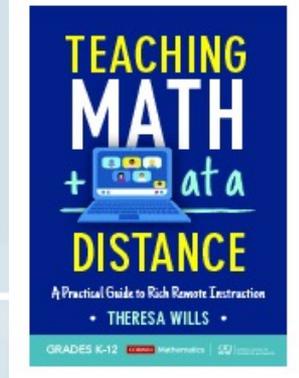
- Responding to Student Thinking
 - Encourage-in-Progress Thinking
 - Revoice Student Contributions
 - Press Student to Elaborate on Their Thinking
 - Advance Students' Contributions
- Promoting Productive Dispositions
 - Promote View of Students as Mathematicians
 - Promote Ongoing Sense Making
 - Emphasize that Learning Takes Time
 - Promote Intentional Listening



What students said....

“...students experienced a sense of competence, as well as recognizing the support provided by teachers. They experience learning as understanding over memorizing.”

Virtual Settings.....Wills 2021



Facilitating Math Discourse in a Virtual Setting-based on Smith & Stein

- Select the objective and identify the task
- Anticipate student strategies and technology use
- Launch the task synchronously
- Allow for small-group work time
- Select and sequence student work
- Design questions for discussion
- Connect student work to the math goal
- Summarize the task



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A rich task is a rich task....

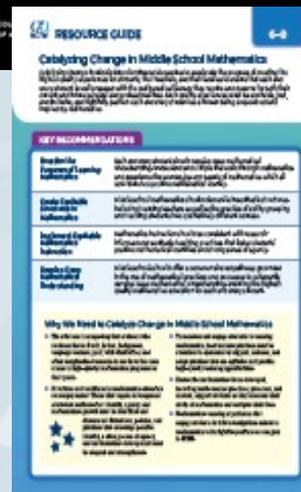
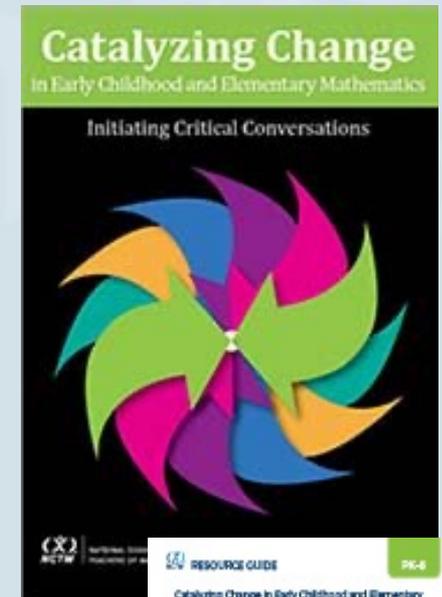
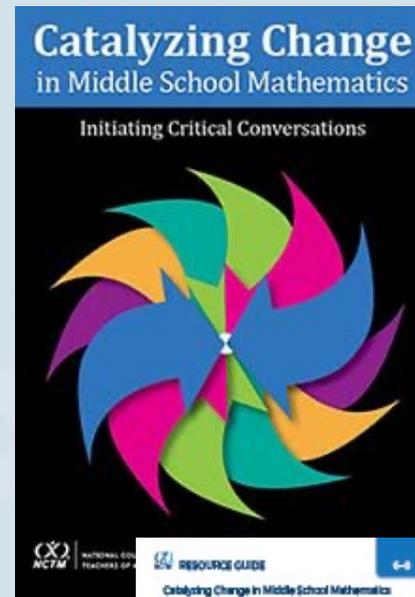
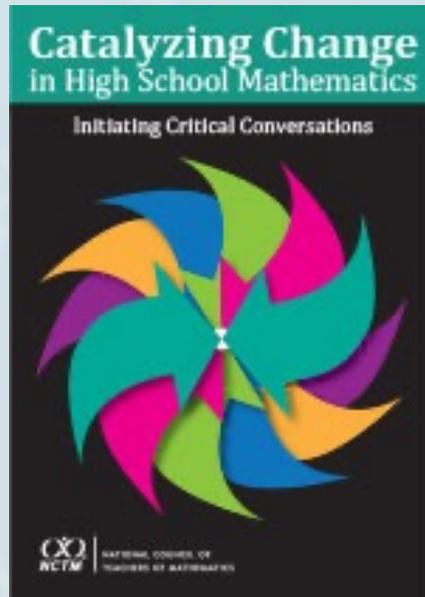
- Is accessible to all learners
- Depicts real-life scenarios
- Allows for multiple approaches and representations
- Allows for collaboration and discussion
- Promotes engagement, curiosity, and creativity
- Offers opportunities for extension

p. 152 in Wills, 2021 from Wolf, 2015

Catalyzing Change Series #nctmchange

www.nctm.org/change

- Infographics
- Resource Guides
- Case Studies
- Webinars
- Book Study Guides
- Position Statements



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Four Key Recommendations

Recommendation 1

**Broaden
the Purposes of
Learning Mathematics**

Recommendation 2

**Create
Equitable Structures
in Mathematics**

Recommendation 3

**Implement
Equitable Mathematics
Instruction**

Recommendation 4

**Develop
Deep Mathematical
Understanding**

Recommendations Across the Grade Bands

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	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.



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Recommendation #1

Broaden the Purposes of Learning Mathematics

**Develop
Deep
Mathematical
Understandin
as Confident
and Capable
Learners**

**Understand
and Critique
the World
Through
Mathematics**

**Experience
the Wonder,
Joy, and
Beauty of
Mathematics**



Recommendation #1

Broadening the Purposes of Learning Mathematics

	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.

What short- and long-term work needs to be done toward achieving this vision of broadening the purposes of learning mathematics?
(What can you do now and what can be done over time?)



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Breakout rooms—google doc link

https://docs.google.com/document/d/1-uRpePI6RTpDn1swGWHSF4PZf5DsVe_vVLa7S4TSsts/edit?usp=sharing

Consider environment.....

- Supports as emergent mathematicians
- Is Empowering
- Offers opportunity for natural curiosity
- Recognizes students as doers of mathematics
- Acknowledges and seeks the joy and beauty in mathematics
- Cultivates and supports student's positive math identity and agency
- Grows intrinsic motivation
- Encourages questioning
- Values student voice

So what if we do not have this type of learning environment for each and every learner?

Without the type of environment that fosters curiosity, wondering, and, questioning, there is an issue of access and equity for each and every learner.

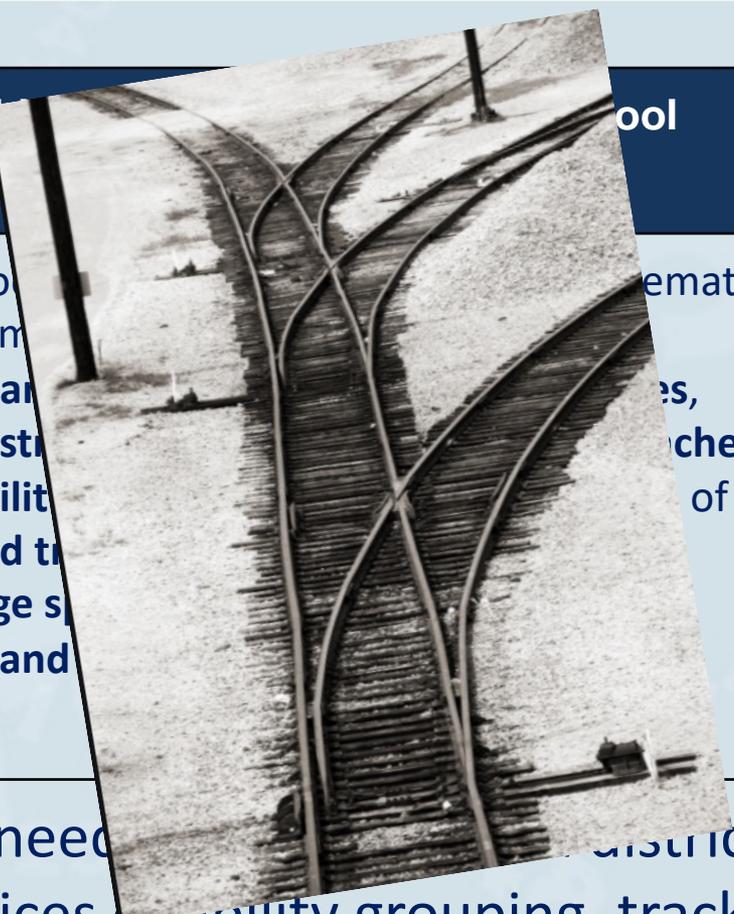
- Impacts development and fostering of positive math identity and sense of agency
- Inhibits mathematical learning
- Widens opportunity gaps
- Limits future access



Recommendation #2

Creating Equitable Structures in Mathematics

	Early Childhood and Elementary School	Middle School	High School
<p>Creating Equitable Structures in Mathematics</p>	<p>Early childhood and elementary mathematics should dismantle inequitable structures including ability grouping and tracking and challenge students from marginality and privilege.</p>	<p>Middle 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.</p>	<p>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.</p>



What supports are needed for districts to discontinue the inequitable practices of ability grouping, tracking, and dead-end course pathways?



Recommendation #3

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Implement Equitable Mathematics Instruction

- Quality of mathematics learning experiences rather than quantity of problems
 - Student Voice-Student Interest-Student Concerns
- Mathematics is seen as a collaborative endeavor
- Students are asked to solve problems in more than one way
- Students are encouraged to share their thinking, not just solutions

**Positive
Mathematical
Identity**

+

**Strong Sense
Mathematical
Agency**

+

**Shared
Mathematical
Authority**

**Students as Empowered
Thinkers and Doers of
Mathematics**

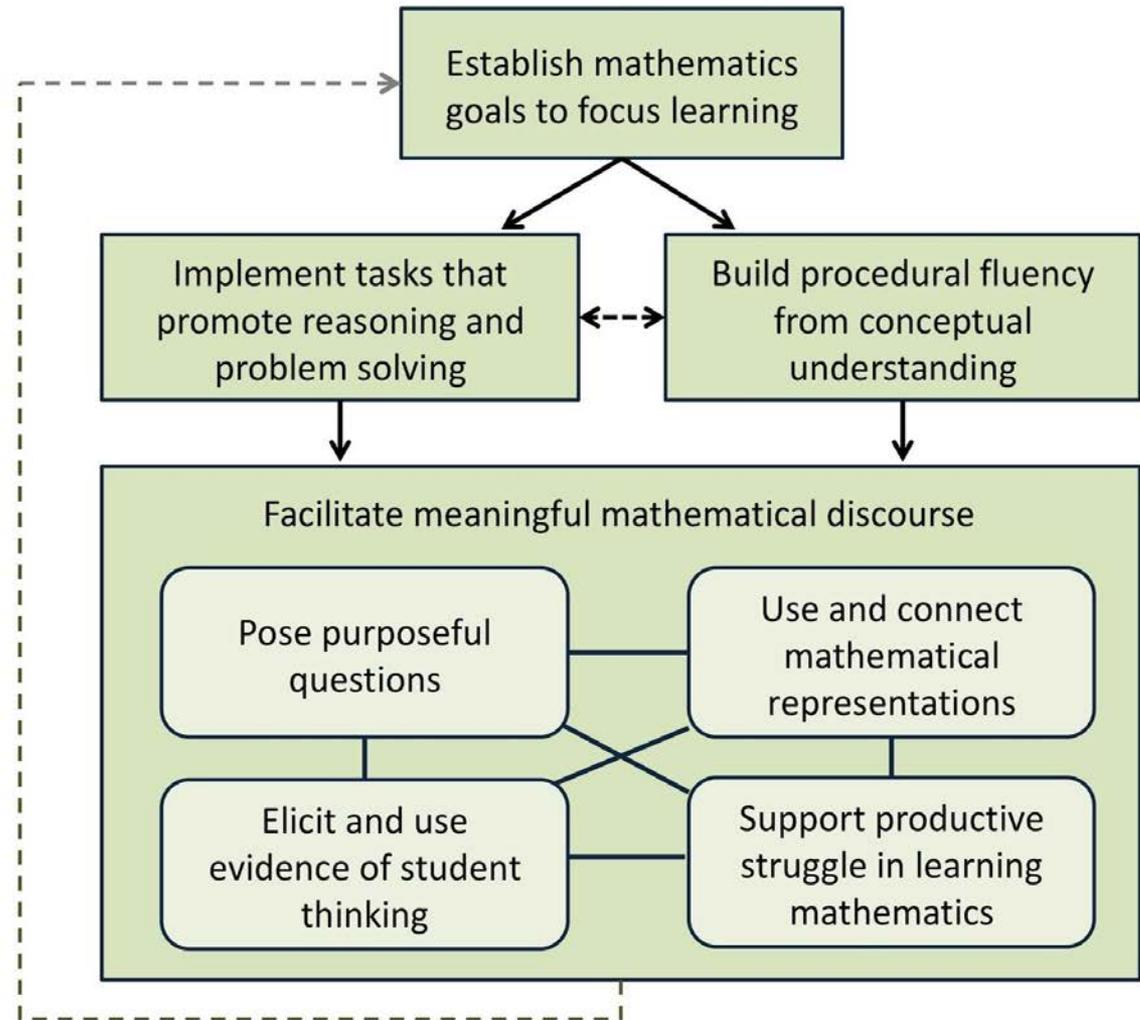


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8 Effective Teaching Practices

High-leverage,
effective
mathematics
teaching practices



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NCTM. 2014. *Principles to Actions: Ensuring Mathematical Success for All*.
www.nctm.org/pta

Mathematics Teaching Framework, (Smith, Steele, & Raith 2017)

Recommendation #4

Develop Deep Mathematical Understanding

	Early Childhood and Elementary	Middle School	High School
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.

What supports are needed to ensure students' development of the mathematical practices and processes within their daily mathematics instruction? What supports do you need in your role?



Sharing

What is your greatest challenge that you are currently facing with teaching and learning mathematics?



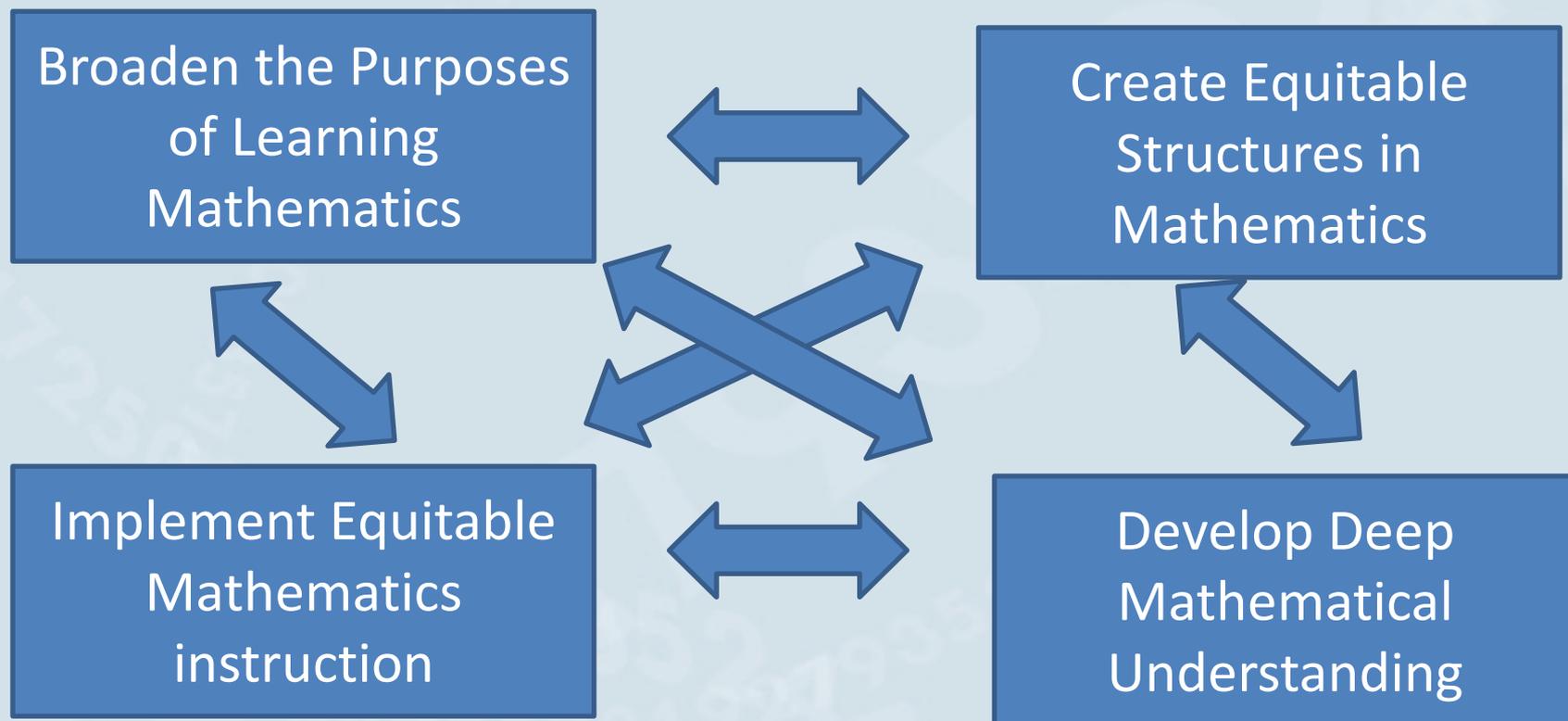
Survey Says.....

Some concerns going forward

- Focusing on learning growth rather than learning loss is critical
- Health & well being of students and teachers
- Using effective teaching practices when social distancing-implementing high-quality instruction
- Assessment practices and use
- Equity in opportunity to learn and instruction
- Focusing on mathematical thinking
- Attendance disparities



Consider Connections



Let's reflect-Consider actions!

My next step or action based on the 4 recommendations in Catalyzing Change.....

More problem solving and inquiry.

Condense curriculum to essential concepts.

Connect more lessons to how and where students would see it in the real-world

Continue to push de-tracking and to push flexible grouping in my district.

Talk to my admin. and colleagues. Now is the perfect time to change.

To keep in mind that our current structure is not the end all be all, there are many other ways to teach math to engage students and ensure you are reaching all your kiddos!

Considering that we had to condense our curriculum this past year, it provides an opportunity to be mindful about what we include next school year and allow more opportunity for discovery activities and deeper thinking.

Keep a positive attitude . Share my love of math.....so my students will love math too. Encourage mistakes....that's how you learn

Work with my colleagues to inject the personal connections into our daily lessons. Make connections!

Making sure students always know that struggling with one math topic or concept does not mean they are bad at "all math" and that they always have support.

Project Based learning

implement more inquiry learning at the high school level

Really look at the process of teacher tracking that has been engrained in the culture of the building and attempt to broaden teaching assignments

To keep an open mind while I am learning how to teach my students math! :)

never stop learning about how my students learn

Keep sharing the "Building Thinking Classroom" framework by Peter Liljedahl. It is transformative.

Help my students to see what they CAN do, rather than what they can't do. Focus on what you know and build from there!

Create opportunities for discovering and analyzing math.

Make connections clear and meaningful

Do more exploration and meaningful activities.

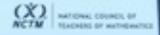
Try and reduce the amount of standardized testing that is done each year

Leadership Perspectives
and
Professional Development



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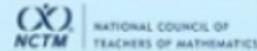
Diversity in
the Classroom



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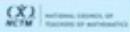
*we teach
mathematics
and more*

- access
- equity
- empowerment



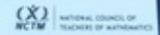
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Developing
Meaningful Mathematics
Lessons



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Engaging with
Families



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<https://www.nctm.org/Membership/Mathematics-and-More/>

NCTM Grants & Scholarships

From Mathematics Education Trust (MET)

- 30+ grants, scholarships, and awards available to NCTM Members
- \$150,000 annually in funding to teachers, schools, and organizations
- Awards for:
 - Coursework and Scholarships
 - Professional Development
 - Research
 - Conference Attendance

	Winter Cycle	Summer Cycle
Opens	August 1	February 1
Due	November 1	May 1
Notification	February	July

www.nctm.org/grantsawards



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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)



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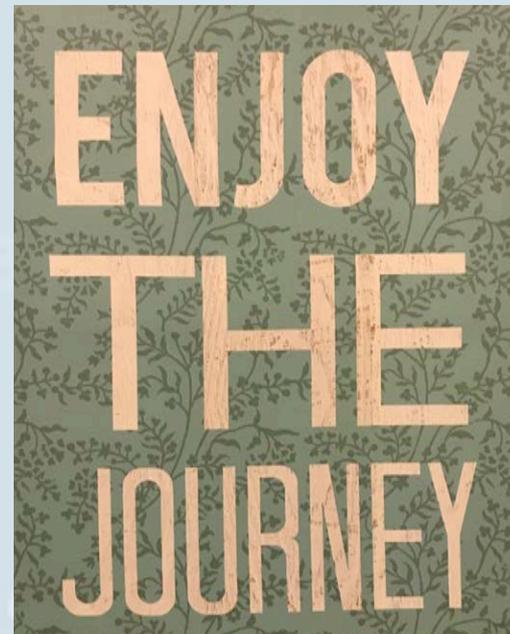
The Journey

Teaching math is a journey we take with not only our students but our colleagues, friends, family, and more each day, week, month, and year, over our lifetime. So, enjoy the journey into the knowns and the unknowns and let's do it together!

(Wilkerson, 2020)



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Thank You!

Questions? Comments?

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Trena Wilkerson

twilkerson@nctm.org

[@TrenaWilkerson](https://twitter.com/TrenaWilkerson)



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Virtual **2021**
ANNUAL MEETING
April 21–May 1