

# Is 2020 Vision Good Enough?

*Looking Ahead to  
What Comes Next*

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# Discussion

- What's the **worst thing** about math classrooms in the spring of 2020?
- What do you envision as the **best thing** about math classrooms in the fall of 2020?



# This session

- The evolving vision from the profession over the years
- Changes in classroom practice and student learning over time
- How good was our vision toward 2020?
- Pressing priorities as we envision the future and take action onward from 2020

# The Evolving Vision

- 1977: NCSM (and NCTM) *Position Paper on Basic Skills*
- 1980: NCTM's *An Agenda for Action*
- 1985: CA K-12 Mathematics Framework
- 1987-89: NCTM's *Curriculum and Evaluation Standards*
- 1989: NRC's *Everybody Counts*
- 1991: NCTM's *Professional Standards for Teaching Mathematics*
- 2000: NCTM's *Principles and Standards for School Mathematics*
- 2001: NRC's *Adding It Up*
- 2006: NCTM's PK-8 *Curriculum Focal Points*
- 2010: Nat'l Governors' Assoc.'s *Common Core State Standards*
- 2014: NCTM's *Principles to Actions*
- 2018: NCTM's *Catalyzing Change in High School Mathematics*

# The Evolving Vision

- Problem solving a top priority
- Cathy's 8 words for the message of the NCTM standards: *All students doing meaningful mathematics using appropriate tools*
- Equity and access increasingly emphasized
- Environment, task, discourse
- Meaningful assessment

# The Evolving Vision

*Our Continuing? Vision*



# Discussion

- How much has changed in our vision of what math classrooms and programs should look like?



# How far have we come?

- Curriculum and standards
- Instructional practice
- Student performance

# Curriculum and Standards

- Essentially every state's standards have a *tighter focus* with *fewer standards* through middle school, emphasizing a *balanced program* of conceptual understanding, computational fluency, and problem solving.
- Many states now require *more math* for high school graduation.
- (The *high school* math curriculum—courses and standards—is *still overcrowded*, not relevant to many students, and aimed at calculus with a fixed alg/geom/alg II structure.)
- The number of *high-quality instructional materials* and resources has increased.
- (The number of *instructional resources of other than high quality* has also increased . . .)

# Instructional Practice

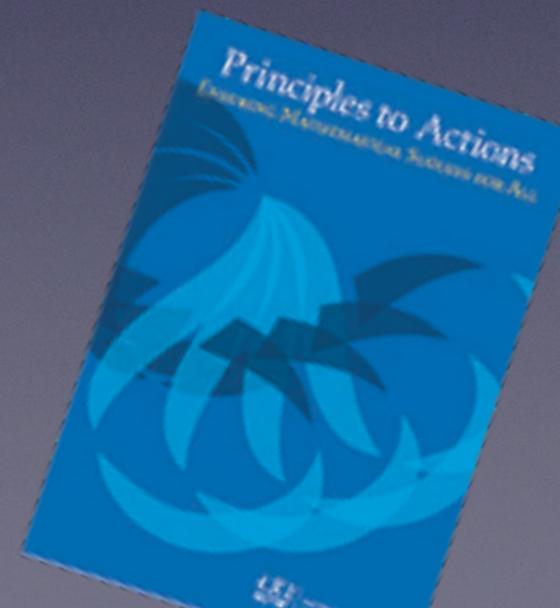
# Discussion/Reflection . . .

- What changes (improvements?) have you seen in terms of *how teachers teach math* today compared to 20/30/40/50 years ago?



# Instructional Practice

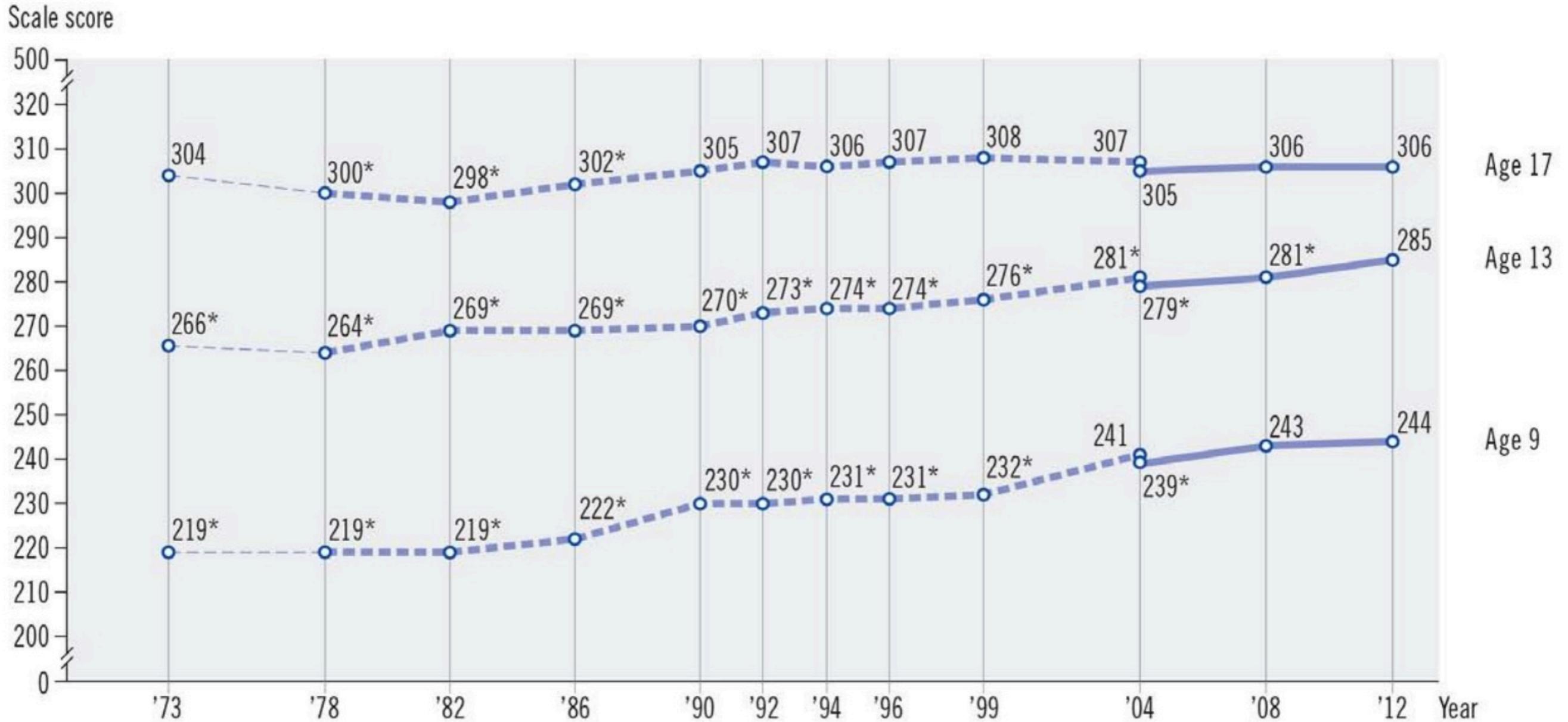
- More teachers are using approaches beyond lecture.
- More teachers are structuring more of their classes around more student discourse.



# Student Performance

# Trend in NAEP Mathematics Average Scores for 9-, 13-, and 17-year-old students

## Mathematics

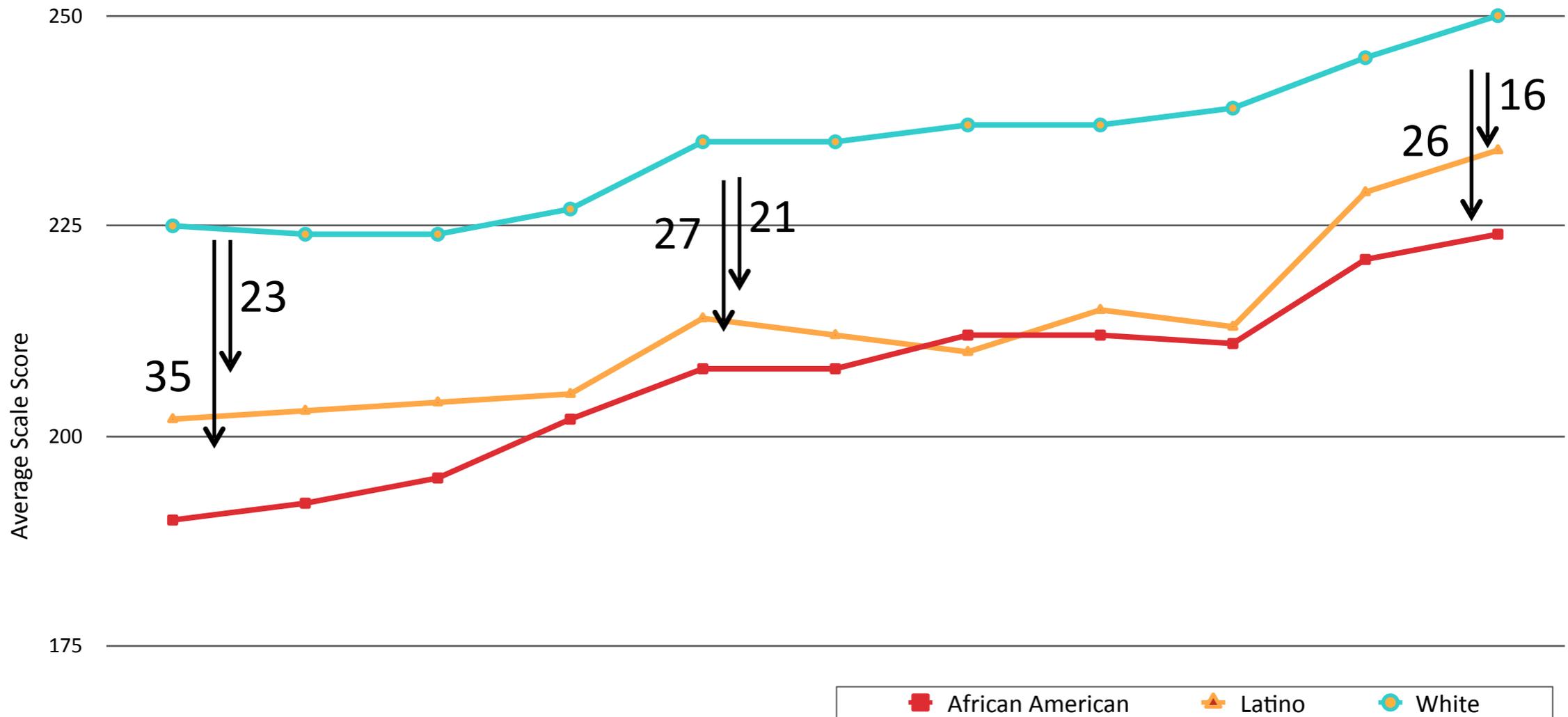


\* Significantly different ( $p < .05$ ) from 2012.

- Extrapolated data adjusting for the limited number of questions from the 1973 mathematics assessment in common with the assessments that followed
- - - Original assessment format using the same assessment procedures established for the first assessment year
- Revised assessment format introducing more current assessment procedures and content

# Record Performance for All Groups

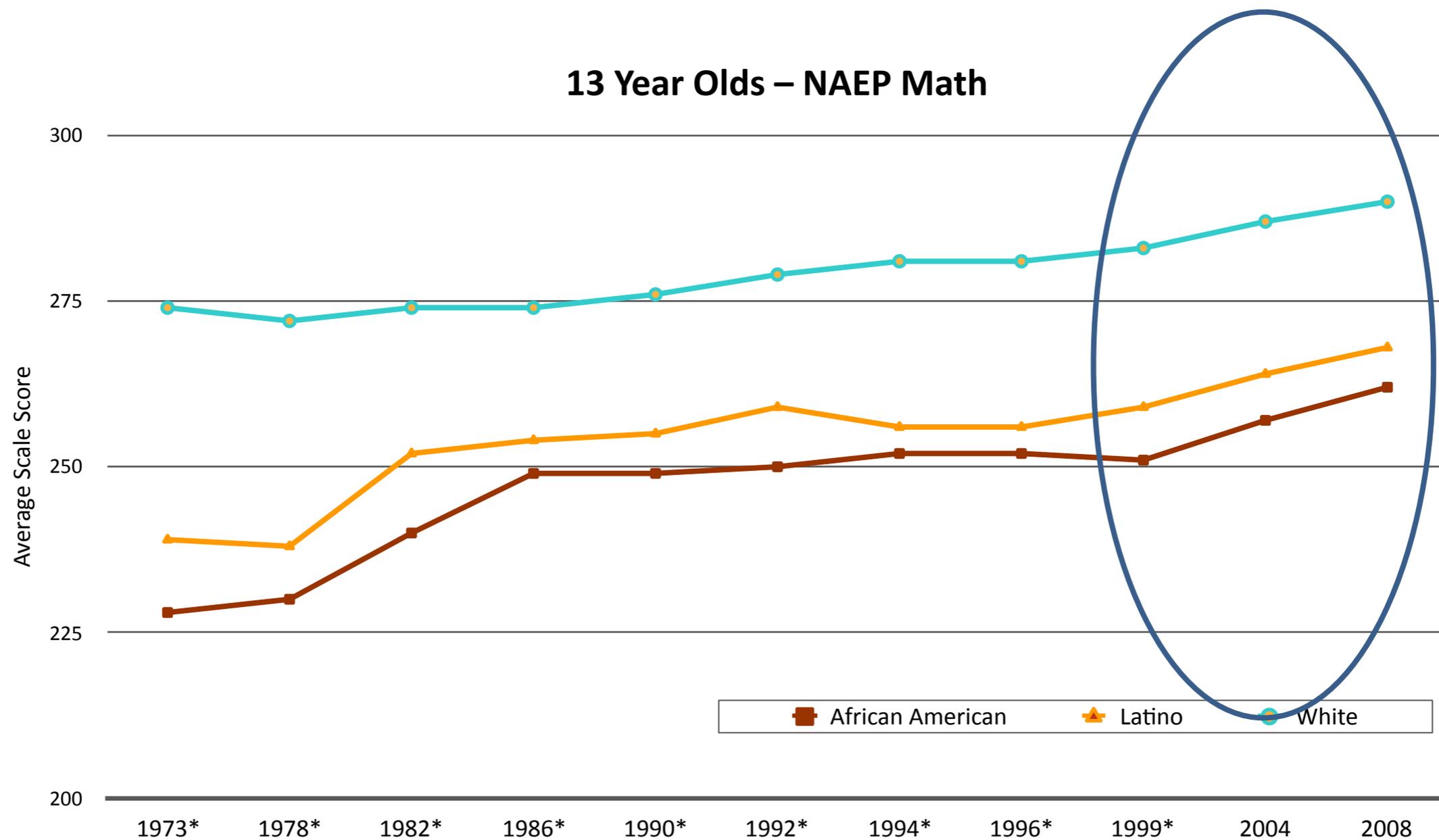
## 9 Year Olds – NAEP Math



\*Denotes previous assessment format

Source: NAEP 2008 Trends in Academic Progress, NCES

# 8<sup>th</sup> Grade Math: Progress for All Groups, Some Gap Narrowing

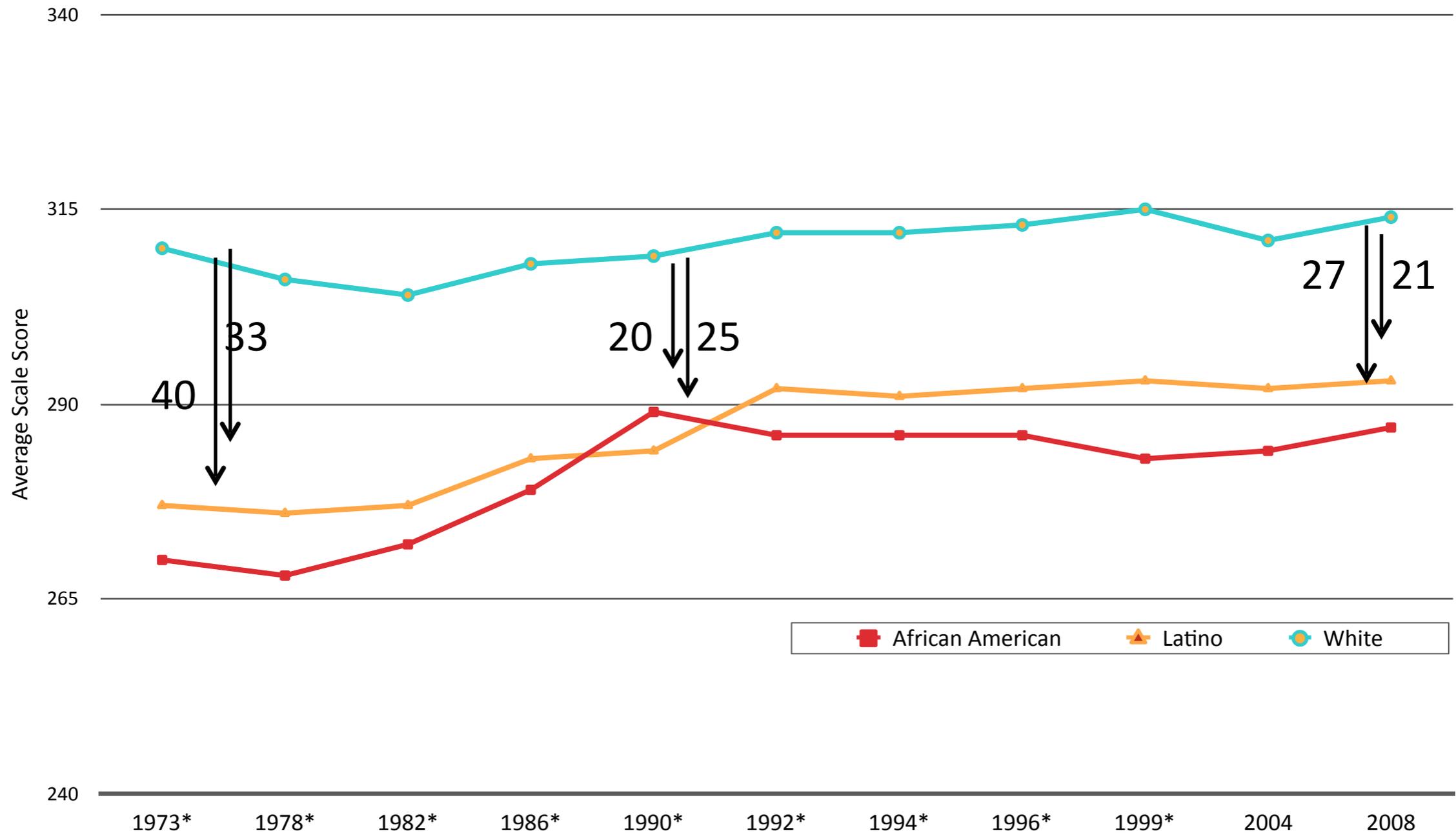


\*Denotes previous assessment format

Source: NAEP 2008 Trends in Academic Progress, NCES

# Since 1990, African American – White Gap Has Not Narrowed

17 Year Olds – NAEP Math



Source: NAEP 2008 Trends in Academic Progress, NCES

\*Denotes previous assessment format

# Discussion/Reflection . . .

- How appropriate has our vision been over the past four decades?
- What needs to change in our vision for the next decade (or 2 or 3 or 4)?



# Some Questions About Priorities

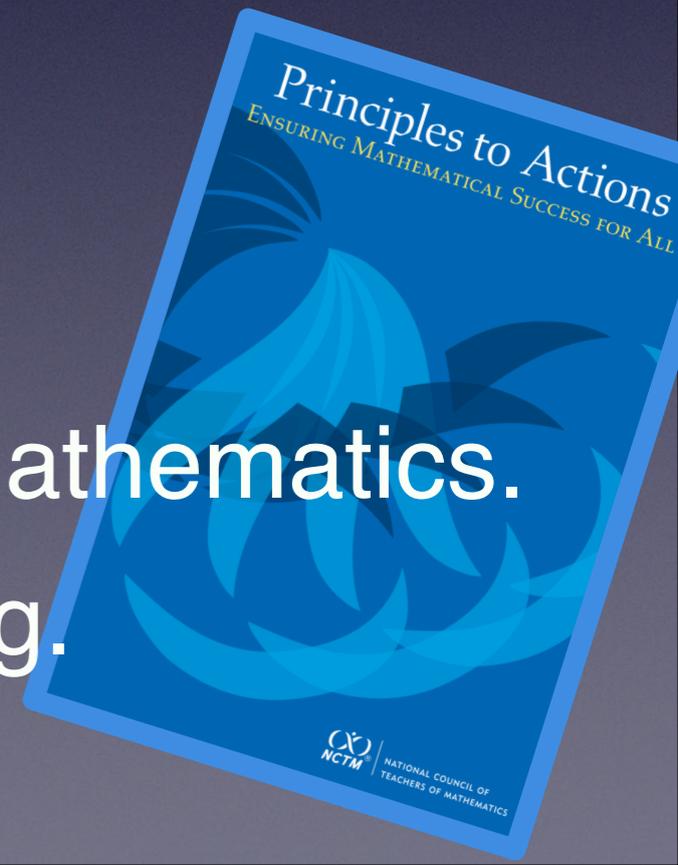
1. Is it possible for even more teachers to focus even more effectively on **structuring classrooms around student thinking**?
2. How can we **stimulate student discourse** in an increasingly **online structure**?
3. How much **mathematical modeling** can/should we incorporate into **elementary/secondary mathematics**?
4. Can we **finally fix high school**? What courses, sequences, pathways, and structures can support more students in **preparing for their futures**?

# Question/Priority #1: Teaching

- Work to help more teachers implement research-based effective teaching strategies . . . .

# NCTM's Effective Teaching Practices

- Establish **mathematics goals** to focus learning.
- Implement **tasks that promote reasoning** and problem solving.
- Use and connect **mathematical representations**.
- Facilitate meaningful **mathematical discourse**.
- Pose **purposeful questions**.
- Build **procedural fluency** from conceptual understanding.
- Support **productive struggle** in learning mathematics.
- Elicit and use **evidence** of student thinking.



# Question/Priority #2: Online Discourse

- **Commitment:** Students sharing their thinking and engaging in discourse is a critical element of deep and lasting learning as mathematical thinkers.
- **Exploration:** Continue to tap into the expanding capabilities various technological platforms have to offer in terms of interpersonal, real time communication.
- **Advocacy:** Aggressively advocate for the importance of face-to-face, in-person interpersonal connections in education. A computer does not—should not—cannot eliminate the need for human interaction as an essential part of learning to think mathematically.

## Question/Priority #3: Mathematical Modeling

- Recognize the difference between and importance of:
  - basic word problems (procedures in ‘context’)
  - application problems (applying procedures)
  - modeling problems (investigations, usually ill-defined and more in-depth)
- Incorporate grade-appropriate investigations/tasks that build pre-modeling skills (questioning, connecting, applying, trying out different approaches, etc.).
- Give high school students experience with some real modeling investigations.

# Question/Priority #4: High School

- Rethink what courses count for graduation requirements.
- Get rid of Algebra II as an expectation for all students.
- Make relevance a key priority.
- Restructure courses away from Algebra I/II/Geometry toward more integration of key topics with other critical content.
- . . .

# Question/Priority #4: High School

- Consider the importance of both content and cultural implications of topics like:
  - financial literacy (credit, debt, investing)
  - mathematical modeling (spread of disease, economic projections)
  - discrete math (matrices, networks, graph theory)
  - practical statistics (understanding research)
  - analysis of data (including 'Big Data' and forecasting algorithms)
  - socioeconomic patterns (including issues related to extreme poverty, such as food deserts and equitable access to appropriate technology)
  - evolving technologies and uses of mathematics
- Consider the paths our students might pursue . . .

# Discussion/Reflection . . .

- What jobs or careers might today's students pursue after high school or college?
- How well do current high school courses prepare them for the range of jobs or careers they might pursue?



# Discussion/Reflection . . .

- Which of these priorities or questions or **what other priorities or questions** would you offer as we create a vision of the future?



# Unheeded Guidance . . . .

- We need to de-track schools (and math classes) to avoid limiting opportunities and overlooking talent.
- Teachers and programs should focus on reasoning and sense-making, or students may not learn to think.
- If we raise our expectations without changes in programs and support, more students will drop out.
- Don't over-emphasize testing, or teachers will teach to the test.

# Unheeded Guidance?

- Don't move to online education as a primary structure or we'll lose too much of what goes into the kind of student learning experience that serves a student in life outside of school.

# Focusing our vision

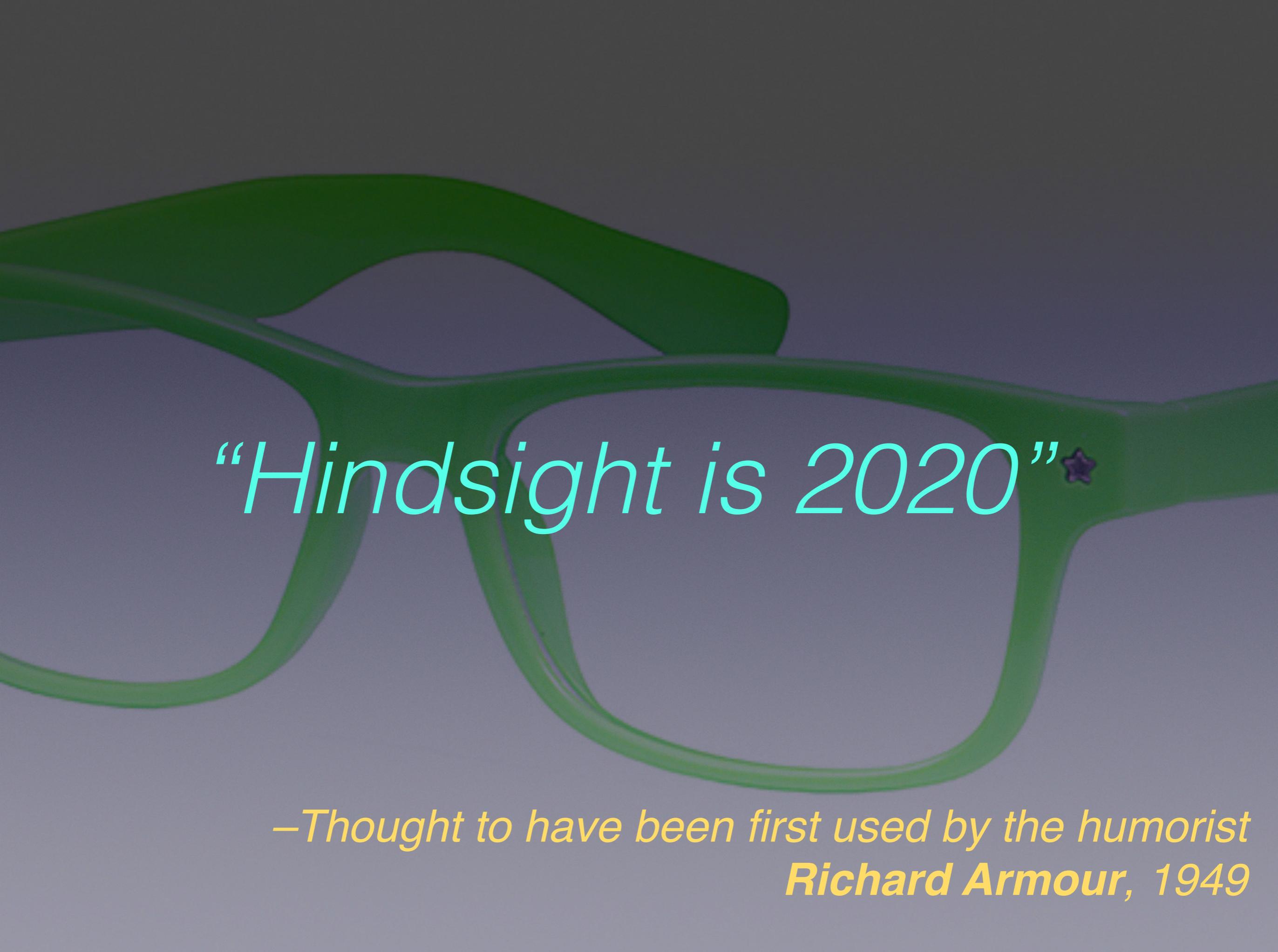
- When we look at the student learning data in 2030 and 2040, will we see real gains in both opportunity and outcomes, with strong student performance across all groups of students?

# Envisioning and Acting

- Let us recommit to helping every teacher effectively implement **research-based teaching practices** to help students become mathematical thinkers.
- Let us help **shape the use of technology** as a tool in support of, rather than a replacement for, effective instruction.
- Let us learn about and incorporate **mathematical modeling** through high school, building pre-modeling skills across the grades.
- Let us finally come together and **create a high school mathematics program** that reflects needs, priorities, and options for today's students.

# The Math Experience Every Student Needs and Deserves

- A program that includes **important and relevant content**, with opportunities to **use what they learn** in meaningful ways.
- A classroom that includes **rich tasks** and interesting problems; where **student thinking is nurtured and valued** and **student voices are heard**
- The opportunity to **struggle in productive ways** with increasingly challenging mathematics that prepares every student for options in the future.
- **Adults who continue to learn** and who **do whatever it takes** so that **every student can learn, think, achieve, and be smarter tomorrow than today.**

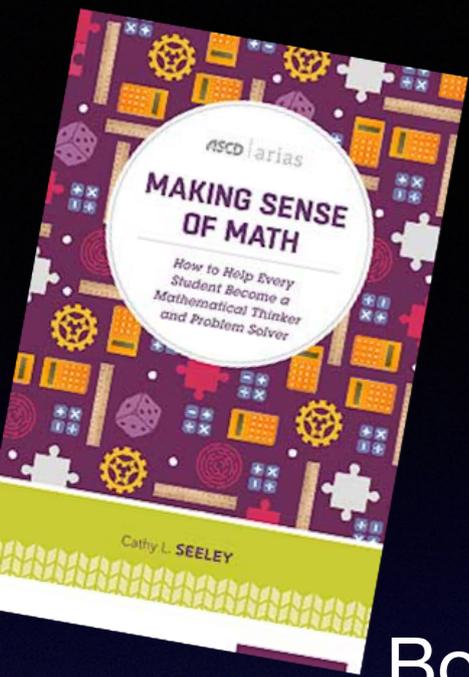


*“Hindsight is 2020”*

*–Thought to have been first used by the humorist  
Richard Armour, 1949*

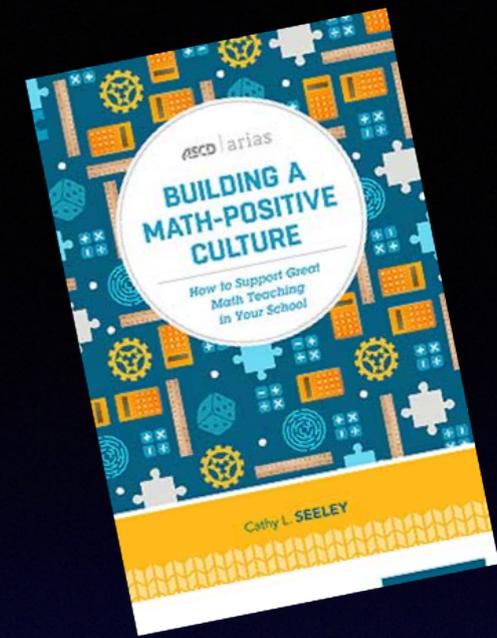
*Every student deserves the best future  
we can prepare them for.*





For a pdf of the slides: [cseeley@utexas.edu](mailto:cseeley@utexas.edu)

Two short books from ASCD/NCSM/NCTM:  
***Making Sense of Math*** (for a general audience)  
***Building a Math-Positive Culture*** (for leaders)



Books of Cathy's 'Messages' published by Math Solutions:  
***Faster Isn't Smarter--***

***Messages About Math, Teaching, and Learning in the 21st Century***

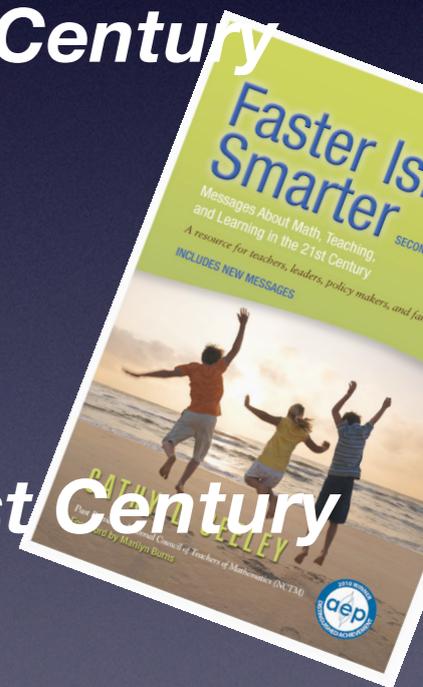
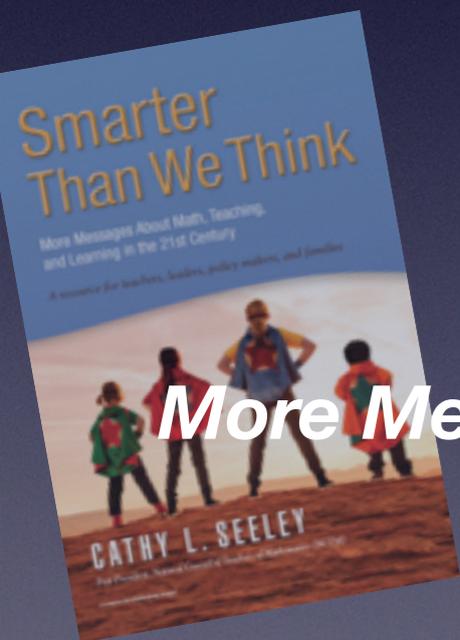
Second Edition 2015 (4 new messages)

<http://mathsolutions.com/fasterisntsmarter>

***Smarter Than We Think:***

***More Messages About Math, Teaching, & Learning in the 21st Century***

<http://mathsolutions.com/smarterthanwethink>



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