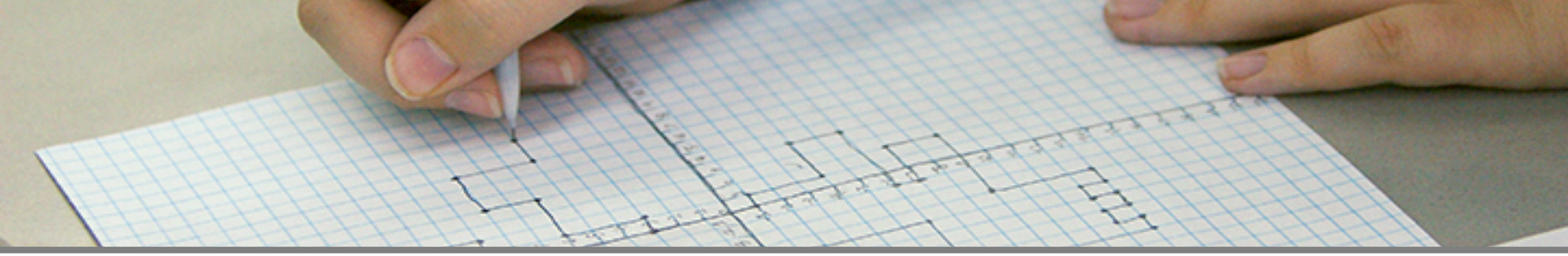

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EDC Education Development Center

DEbT-M equitable opportunities for all

Mathematics & Equity: Tackling the Hard Conversations

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NCSM 2018

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Two Important Findings

1. School is a *resistant system*, but resistant systems can be impacted by change agents who tackle foundational problems!

   – Lukacs & Galluzzo, 2014

2. Teacher leadership in schools is actually correlated to student achievement

   – Ingersoll, Sirinides & Dougherty, 2017

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Change—Whose job is it typically?

"Top Down"

- Teacher is passive recipient and implementer of the change initiatives of others
- Change is successful IF the implementation coincides with an outsider's view

"Educator Leader"

- Teacher as a leader, but… reform efforts are prescribed
- "Leader" means many things
- Focus of change remains in the hands of administration

In common models, classroom-based teachers have little agency as professionals; they are often not involved in initiating or conceptualizing systemic change; they are not empowered.

—Karrin S. Lukacs and Gary R. Galluzzo, 2014

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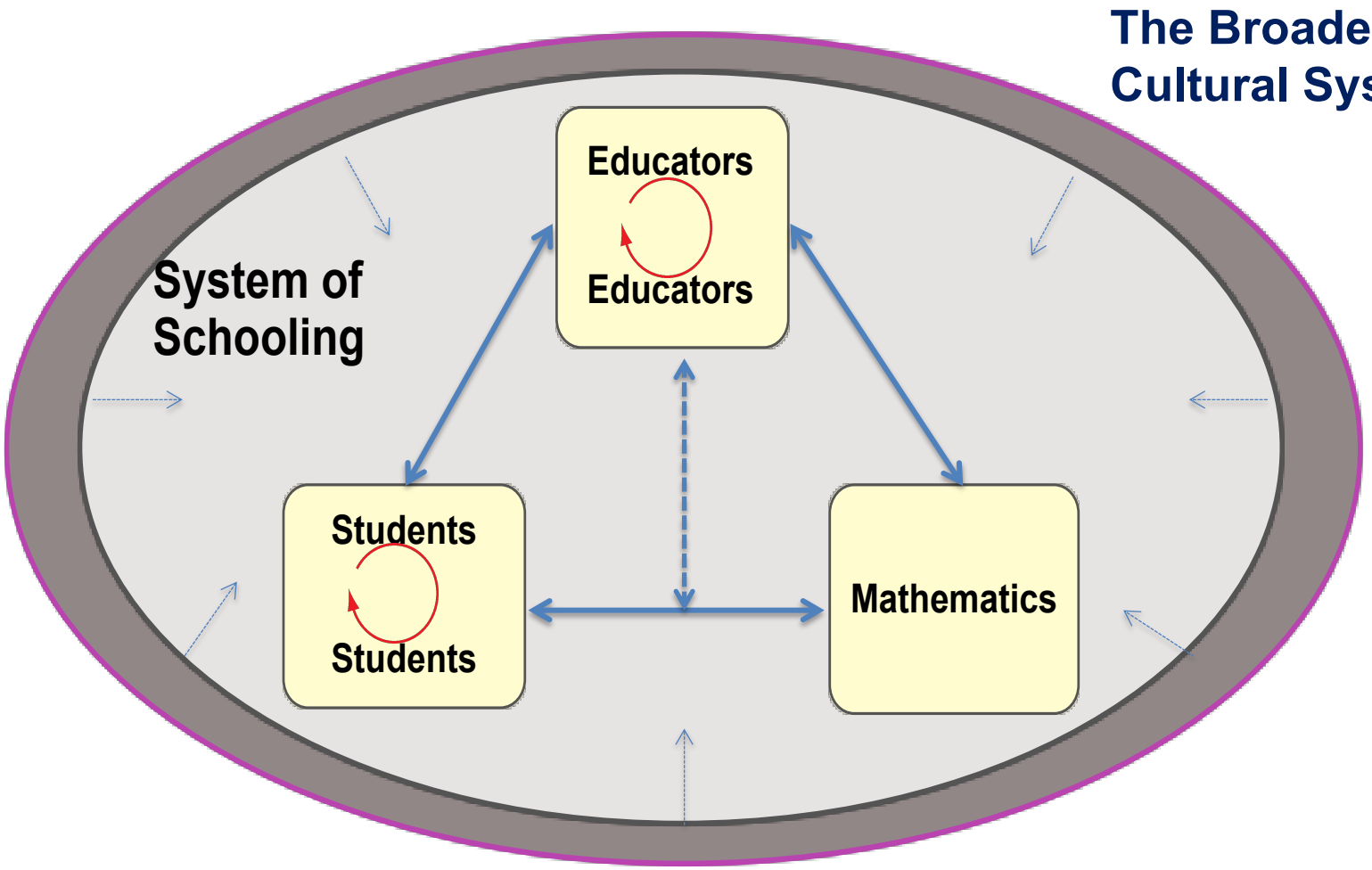
The system at work



What we'll do today

- Look at a way of thinking about teachers' mathematical practices.
- Look at a way of thinking about teachers' equitable practices.
- Examine data that ties the two together.

What mathematical knowledge empowers teachers (to empower students)?

Mathematical Habits of Mind (MHoM)

Specialized ways of approaching mathematics that resemble those employed by mathematicians. They are:

- about the *thinking*, *mental habits*, and *techniques* used to develop definitions, theorems and algorithms;
- *not* about the particular definitions, theorems or algorithms;
- aligned with the CCSSM Standards for Mathematical Practice.

Mindless algorithm use

- Problem: Round 2005 to the nearest 1000.
- Kid: 3000.

- Martin, Meerts, Oehmke, Tyler, Sword, Matsuura (2017)

Sample problem

Find the maximum value of the function:

$$f(x) = 11 - (3x - 4)^2$$

Find as many solutions methods as you can!

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Sample teacher response

$f(x) = 11 - (3x-4)^2$. Anything squared is ≥ 0.

Therefore, 11 - (stuff squared) must be ≤ 11. So 11 is the max.

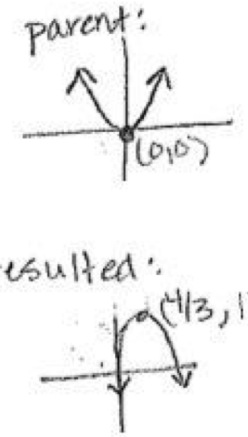
Sample teacher response

Parent function is $f(x) = x^2$.

$f(x) = 11-(3x-4)^2$ is a matter of translations from the parent function.

$f(x) = -(3x-4)^2 + 11$ so it has shifted up 11 units $(+11)$, is flipped about the x-axis $(-)$, and shifted right 4/3 units $(3x-4)$.

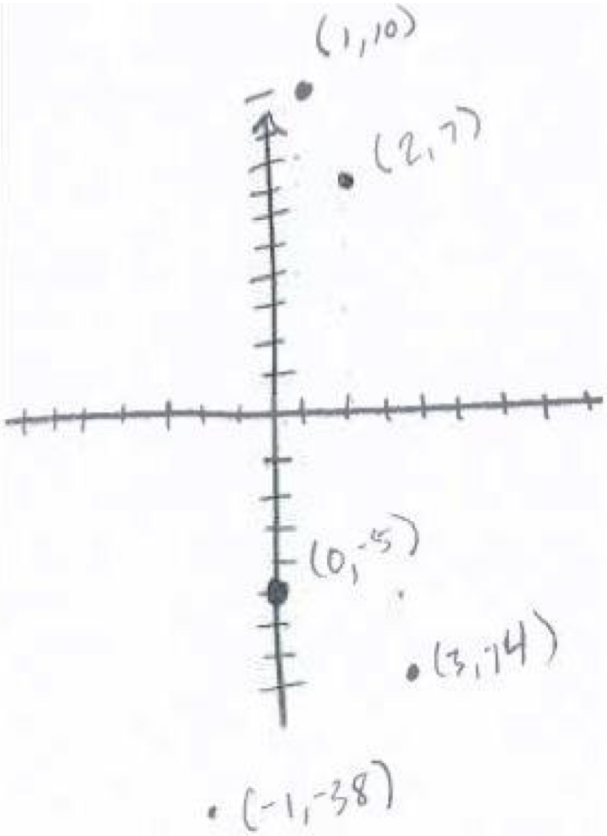
Maximum value point is at $(\frac{4}{3}, 11)$.



Sample teacher response

x	$11-(3x-4)^2$	y
-2	$11-(-6-4)^2$	-89
-1	$11-(-3-4)^2$	-38
0	$11-(-4)^2$	-5
1	$11-(3-4)^2$	10
2	$11-(6-4)^2$	7
3	$11-(9-4)^2$	-14
4	$11-(12-4)^2$	-53

max will be somewhere in this range.



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Using Mathematical Structure

Mindful use of existing structure of an algebraic expression.

One more quick example:

- Simplify $(99^2 - 1) + 8(99^2 - 1) - 11(99^2 - 1)$.

Using Mathematical Structure

- By viewing $(99^2 - 1)$ as a common term, the expression becomes $3\clubsuit + 8\clubsuit - 11\clubsuit$, which equals $0\clubsuit$ or 0

Measuring Teachers' Habits of Mind

- The "max value item" comes from the NSF-funded *Assessing Secondary Teachers' Algebraic Habits of Mind* (ASTAHM) project.
- ASTAHM is a collaboration between Boston University, Education Development Center, and St. Olaf College.
- Valid and reliable instrument.
- Emerging research links ASTAHM teacher outcomes with student outcomes on standardized tests.
- Tool for research, *not* for individual teacher evaluation!

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What do habits and practices have to do with equity?

Habits of Mind and Equity

- Mathematical Habits of Mind empower *teachers* to:
  - See the mathematical content of students' emerging ideas.
  - Build on students' mathematical strengths.
  - Value students' thought processes.
  - Encounter new mathematics.
  - Foster habits of mind in students!
- Mathematical Habits of Mind empower *students* to:
  - Participate in a fundamentally human aspect of doing mathematics: creating it!

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What understandings empower teachers to provide equitable opportunities to learners?

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About DEbT-M

NSF-funded MSP *Designing for Equity by Thinking in and about Mathematics*

Our collective goals:

- Take ownership of reducing the opportunity gap experienced by students of color
- Support educators as agents of change to disrupt systemic forces that traditionally construe lower performing students as deficient

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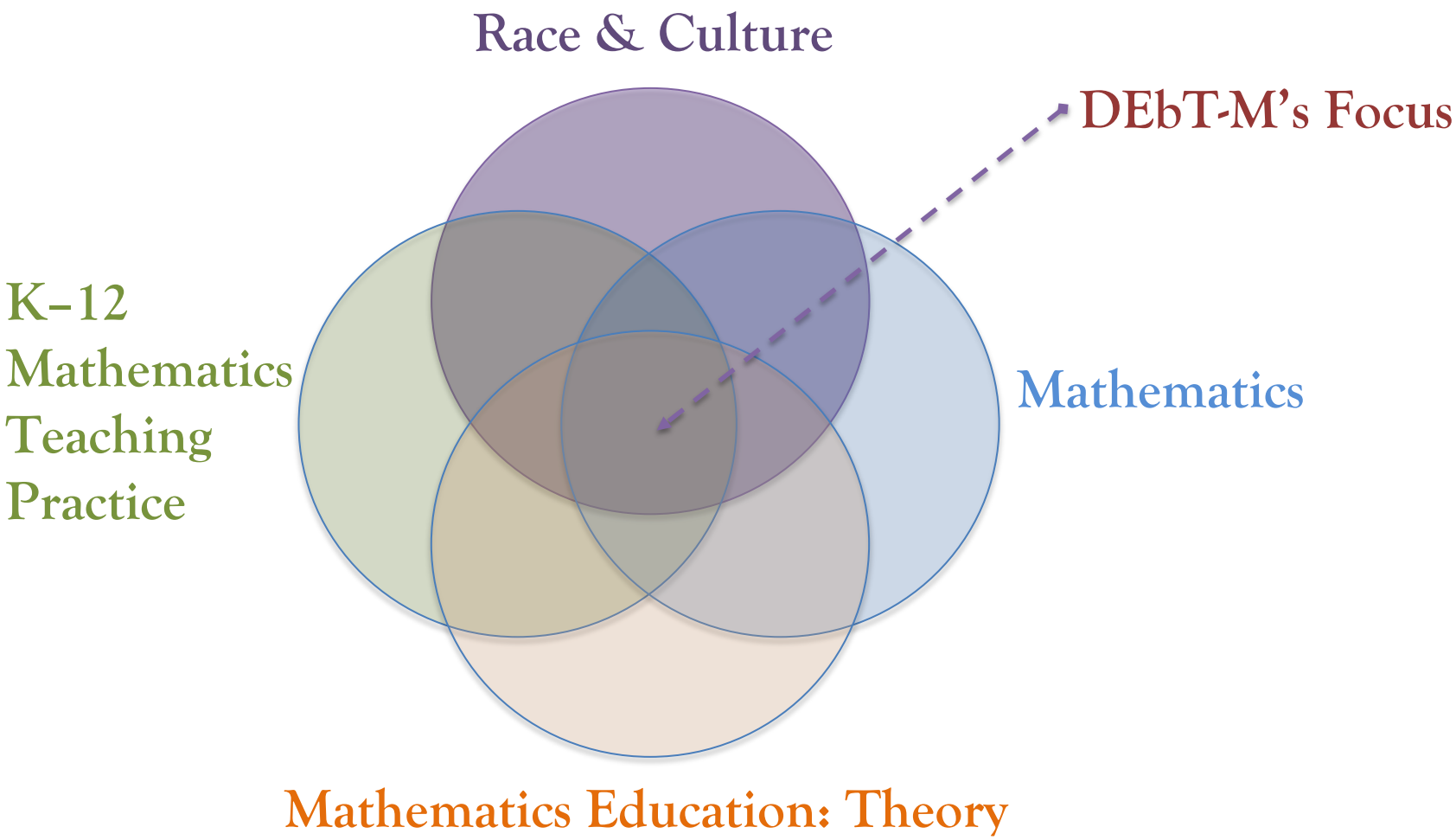
DEbT-M foundational principles

1. An explicit focus on race is essential to our work.
2. Each student is able and deserves to engage in a community that authentically reflects how mathematicians think about and do mathematics.
3. The system of school mathematics has precluded students from engaging in serious mathematics.
4. We have an individual and communal responsibility for reshaping this system to provide each student access to advanced mathematical ideas.
5. Mathematics involves ways of thinking that individuals can learn to use to raise and approach problems and experience the world.
6. Teachers want to act in their students' best interest.

—Winger et al., 2018, pp. 94–95

DEbT-M



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MathEquity

- It is a space to foster wholeness. In this context, "whole" means being a person and a mathematician at the same time, no matter who you are.
- We followed the teachers' lead regarding what to talk about;
- We listened purposefully to identify issues of racial equity in their conversations, so we could elevate those issues for two primary purposes:
  1. recognize mathematics as a profoundly human activity; and
  2. fundamentally reshape the classroom experience in ways that value, engage, and focus on students of color.

—Winger, Young, Stovall, Sword, Badertscher, Gates, MacDowell, Cuoco 2018, p. 96

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Disrespect

What do you do when students are disrespectful?

- Think for yourself about what you would do.
- Turn and talk to colleague about what you would want teachers to do in such cases.

Recognizing long-term implications

What we do to learners who disrespect us…

- I don't give them my time.
- They lose my compassion and respect.
- I ignore them; I do not try to get them back on task.
- I do not give them second-chance grading or accommodations.
- I lower my expectations of them.
- They become invisible in my classroom.
- I'll embarrass them and/or call them out in front of the class.
- They lose a relationship with me.

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Isolated instances to systemic patterns

1. These seem not to be about content… at least at the outset
2. These appear rational through certain lenses.
3. What systemic factors actually produce these perspectives in educators?
4. We have to ask ourselves *What do these actions actually do*?
5. Who is really disrespecting whom?

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Educators owning own actions & choices

You [*writing to self*] mistook Dinae's attitude for disrespect. It was easier to turn away when she was on her phone or talking to her friend than to ask why. **You did not take the time to talk to her,** ask how she was feeling. Instead you took it personally, like a slap to your face. **You said to yourself, "I will show her."**

Importance of culture

Culture eats strategy for breakfast.

—Peter F. Drucker

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How are these conversations connected?

What are the research findings when we join these two types of conversations together?

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Teachers' mathematical growth

We have statistically significant growth in teachers use of mathematical habits of mind between the pre- and posttest (separated by 2 years).

Correlated to that growth

In the context of the interconnected mathematics & equity-focused professional development …

This GROWTH is strongly, significantly, positively correlated to two very different instruments administered by two very different audiences, and the findings are mutually reinforcing.

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Correlated to that growth …

In the context of the interconnected mathematics & equity-focused PD, this growth is strongly, significantly, positively correlated to …

externally conducted IQA (Instructional Quality Assessment) evaluations of mathematics teachers' instructional practice, particularly…

rigor in student discussions, student residue, student linking, teacher asking (pressing) and student providing (responding)

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Correlated to that growth

And strongly, significantly, positively to …

Tripod® measures (student responders)

- where "better survey results predict higher student achievement, engagement and motivation, as well as success skills and mindsets," (http://tripoded.com/teacher-toolkit/)

particularly student perceptions of …challenging, consolidating, classroom management and CARING!

Pearson correlations

		AR 3	AR X	AT 3	AT 4	AT5
Change in MHoM summative	Pearson Correlation	.61*	.63*	.56*	.68**	.65*
	N	13	13	13	13	13
Change in MHoM LANG subscale	Pearson Correlation					.71**
	N	* p<.05 ** p<.01				13

Academic Rigor: AR3: Rigor in student discussion or responses & ARX: Mathematical residue.

Accountable Talk: AT3: Student's linking, AT4: Asking (Teacher press) & AT5: Providing (student responses).

Pearson correlations

		C1	C2	C5	C6	C7
Change in Use of Structure	Pearson Correlation	.77**	.47	.56*	.56*	.59*
	N	13	13	13	13	13

* $p < .05$
** $p < .01$
Note: C2 was only moderately significant at $p < .10$

C1: Caring
C2: Conferring
C5: Consolidating
C6: Challenging
C7: Classroom Management

In other words ...

Children feel cared for in these contexts.

Hypothesis: Teachers with strong mathematical practices themselves can engage their students in rigorous content, and that engagement makes children feel cared for and valued.

Some Closing Thoughts

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What impact are we trying to have?

Build teachers' (and ultimately students) competence & autonomy on issues of mathematics and equity

- A feeling of efficacy in the work you do
- The work you do has value
- You contribute to the work
- Your voice matters

This contributes to developing relatedness

~Ryan & Deci, 2017

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Low threshold-high ceiling approach

- Whether in mathematics or equity, we create opportunities to engage with entry points for all participants.
- We create opportunities that connect to major ideas and issues that underlie mathematics and issues of racial equity.

- We make choices to surface mathematical and racial issues, rather than to "cover topics." It takes time, and it's not always comfortable. But the practice outcomes and student outcomes suggest that it's worth the effort.

Thank you!

- For questions or comments, please email:

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