# Working Together to Develop an Understanding of Equity-based Mathematics Teaching Practices

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National Council of Teachers of Mathematics
Annual Meeting and Exposition
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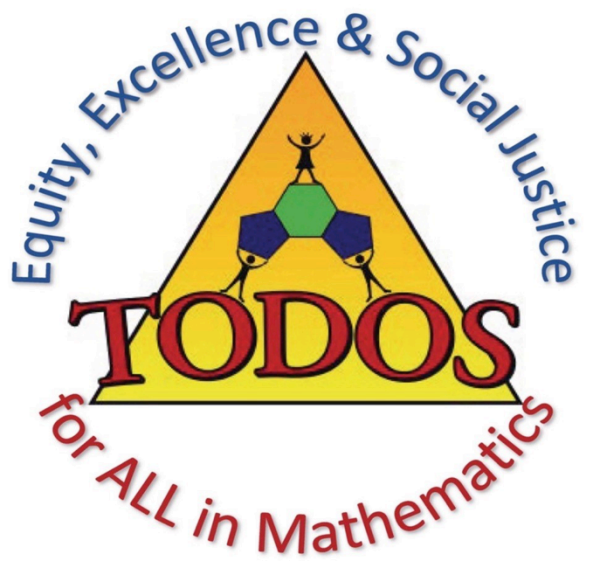
***The mission of TODOS: Mathematics for ALL is to advocate for equity and high quality mathematics education for all students— in particular, Latinx students.***

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NCTM AFFILIATE
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## June 25 - 27, 2020

## TODOS Mathematics for ALL

## Scottsdale Plaza Resort, AZ

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# Session Overview

- Introduction
- Problem Posing with Headlines: alignment with
  - 5 Equity-based Instructional Practices (Aguirre, Mayfield-Ingram, & Martin, 2013)
- Modifying Lessons to address Access and Equity
- Vignette
- Questions
- Resources

"An excellent mathematics program requires that all students have access to a high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential" (NCTM, 2014, p. 59).

Also needed is a "systemic approach that includes fair and equitable teaching practices, high expectations for all students, access to rich, rigorous, and relevant mathematics, and strong family/community relationships to promote positive mathematics learning and achievement" (Joint Position Statement from NCSM and TODOS, p. 1).

# NCTM Position Statement-Key Ideas

1. Being responsive to students' backgrounds, experiences, cultural perspectives, traditions, and knowledge.

2. Ensure that all students routinely have opportunities to experience high-quality mathematics instruction, learn challenging mathematics content, and receive the support necessary to be successful.

3. All students attain mathematics proficiency.

# Equity-based Instructional Practices (Aguirre et al., 2013)

1. Going Deep with Mathematics
2. Leveraging Multiple Mathematical Competencies
3. Affirming Mathematics Learners' Identities
4. Challenging Spaces of Marginality
5. Drawing on Multiple Resources of Knowledge

How might problem-posing with headlines align with these equity-based practices?

# Problem Posing: Headlines

## March Madness odds: 2019 Final Four betting lines, trends

*Auburn and Texas Tech enter the Final Four as the underdogs on the college basketball betting lines facing Virginia and Michigan State.*

## No Joke: Sales Tax Increasing In 51 California Cities On April 1

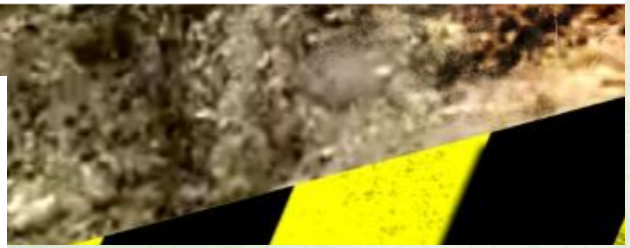
## US would reportedly run out of avocados in 3 weeks if POTUS shuts down border

# Problem Posing: Headlines Examples

## Doing the math on the big lottery jackpot

POSTED 11:22 AM, OCTOBER 24, 2018, BY JIM ALTMAN

## Waco: Nearly 54,000 gallons of wastewater discharged



## Voters to begin heading to the polls Monday

By CASSIE L. SMITH csmith@wacotrib.com Oct 20, 2018

# Problem Posing: Headlines


1. Examine averages over the years
2. Applicable to college students, and us as future parents!
3. How can you ensure that you don't have a lot of debt for your kids?

# Problem Posing: Headlines Identified

**Migrant caravan: What is it and why does it matter?**

26 November 2018 Share

How long will it take for them to walk?

**'Bad news': CO2 emissions to rise in 2018, says IEA chief**

October 18, 2018 by Catherine Hours, Marlowe Hood

**Plastic to ride: Indonesians swap bottles for bus tickets**

Iowa Grandmother Wins Half of $688 Million Powerball Prize

# Standards for Mathematical Practice
## (CCSS-M)

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# Modifying Lesson Plans to Address Access & Equity

5 Equity Based Instructional Practices Jigsaw

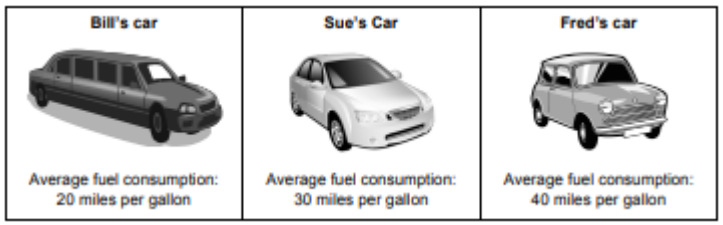
Students' summaries:

1. Going Deep with Mathematics – connected to MTPs/SMPs
2. Leveraging Mathematics – find students' strengths and use them
3. Affirming Mathematics Learners' Identities – promote participation (multiple entry points, various ways to contribute)
4. Challenging spaces of marginality – students may feel isolated, so address that. Value what students bring.
5. Funds of knowledge – bridge home and school knowledge.

# Modifying Lesson Plans to Address Access & Equity

Middle School

## Comparing Fuel Consumption: *Buying Cars*




**MATHEMATICAL GOALS**

This lesson unit is intended to help you assess how well students are able to solve a real-world problem that involves rates of change. In particular, it will help you assess how well students are able to create, compare, and evaluate different representations of functions.

Comments PSTs made:

"Do students see these (limos) in their daily lives? Do they buy cars? How much do they already know?"

https://www.map.mathshell.org/lessons.php

# Modifying Lesson Plans to Address Access & Equity

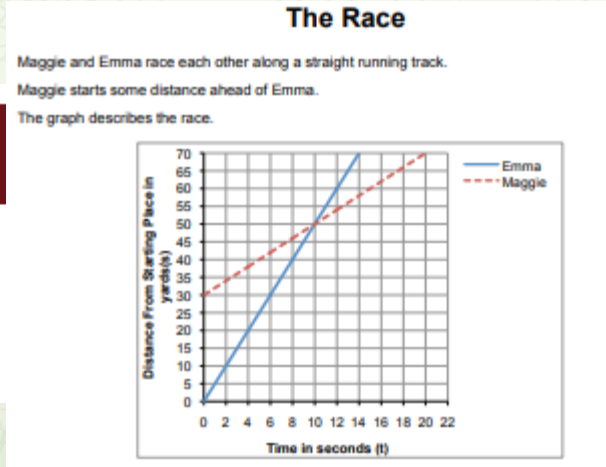
High School

## Comparing Lines and Linear Equations

**MATHEMATICAL GOALS**

This lesson unit is intended to help you assess how well students are able to:

- Interpret speed as the slope of a linear graph.
- Translate between the equation of a line and its graphical representation.




Comments PSTs made:

"Incorporate real-world examples to bridge the home to the school"

https://www.map.mathshell.org/lessons.php

# Modifying Lesson Plans to Address Access & Equity

Middle School: Buying Cars

Both groups identified practices 2 and 5 to work on

**Group 1:** Leveraging Multiple Mathematical Competencies (Practice 2)

The introduction questions use deficit language. Rather than using the phrase "which method is better/more efficient," which focuses on the wrong, rephrase to ask instead about connections and strengths of each approach. All students reached the same conclusions; don't label or compare the students. Students see the information differently; value each representation and comment on the differences, not ranking.

# Modifying Lesson Plans to Address Access & Equity

Middle School: Buying Cars

Both groups identified practices 2 and 5 to work on

**Group 2:** Drawing on Multiple Resources of Knowledge (Practice 5)

Make it more relatable – in Waco, there are no limos. What about SUVs or trucks? Also, make the distances relevant to the students (ie. Home to HEB, or a day trip to a nearby city). If students have interest in cars, let them share what they know about gas, driving, mileage etc.

# Modifying Lesson Plans to Address Access & Equity

High School: Linear Equations

**Group 3:** Drawing on Multiple Resources of Knowledge (Practice 5)

Find real world contexts (so easy to connect in discussion or even matching stories). Give purpose and application; make it relevant

# Modifying Lesson Plans to Address Access & Equity

Activity Reflections

- Ask PSTs to mark-up the lesson plans: show specific examples of where they would change the language or activity.
- PSTs identified the practices that **are** equitable ("they got that practice"); eliminated those and looked at the ones that were more lacking – an understanding that we can't do everything at once!

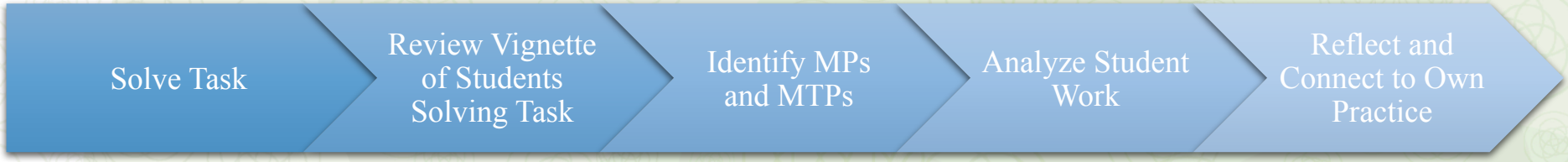
# Mathematics Teaching Practices
**(NCTM, 2014)**

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

# Vignette Activity Sequence – Phase 1

**(Wilkerson, Kerschen, Shelton (2018).** PreService Teachers' Critical Connections to Effective Teaching Practices: An Instructional Approach Using Vignettes. *Action in Teacher Education. 40*(4), 358-373**)**

- Process often begins with secondary PSTs solving a specific mathematical problem that is connected to a mini-vignette.
- PSTs engage in a reading/discussion of a mini-vignette, which is a student or teacher exchange that occurred while secondary students were solving the task. This may also include sample student work.
- PSTs discuss which MPs and MTPs might be addressed in the mini-vignette, providing evidence to justify their claims. This includes looking at both the teacher actions and student work.



# Vignette Recording Sheet

**(Wilkerson, Kerschen, Shelton (2018).** PreService Teachers' Critical Connections to Effective Teaching Practices: An Instructional Approach Using Vignettes. *Action in Teacher Education. 40*(4), 358-373**)**

| | |
|---|---|
| Identify any Mathematical Practices practiced by the students illustrated in the vignette. Provide evidence from the vignette to justify the Mathematical Practices you selected. Please connect your evidence to material/discussions/research discussed in class. | Identify any Mathematical Teaching Practices practiced by the teacher that is illustrated in the vignette. Provide evidence from the vignette to justify the Mathematical Teaching Practices you selected. Please connect your evidence to material/ discussions/research discussed in class. |
| Which equity-based instructional practices are illustrated (from Aguirre et al., 2013)? What is the evidence from the vignette? | How does reflecting on this vignette inform your own practice? What will you take away from this vignette, or what connections can you make to your own teaching or future teaching? |

# Vignette Sample Responses – TED 4349

Identify any **Mathematical Practices** practiced by the students illustrated in the vignette. Provide evidence from the vignette to justify the Mathematical Practices your selected. Please connect your evidence to material/discussions/research discussed in class.

Students modeled an occurrance with math (line 12–15). Construct viable arguments and critique reasoning of others occurred when students supported/ compared views based on data (line 12-15 & line 19–24). Within the discourse, students reasoned both abstractly and quantitatively because they (line 13) represented ratios and applied that to factors to prove or disprove the claims.

Identify any **Mathematical Teaching Practices** practiced by the teacher that is illustrated in the vignette. Provide evidence from the vignette to justify the Mathematical Teaching Practices you selected. Please connect your evidence to material/discussions/research discussed in class.

The teacher implemented a task that promoted reasoning & problem solving. Data was used, but students also had to reason (line 13-15 & line 6-8). He supported students' equity by providing & facilitating "meaningful mathematical discourse" regarding equity (line 20-23). Students made conjectures and looked for relationships because of the teacher's use and evidence of student thinking that sparked the idea for the lesson (line 1-5)

Which equity-based instructional practices are illustrated (from Aguirre et al. 2013)? What is the evidence from the vignette?

Students "went deep with math" because they applied data to make conjectures/ arguments (line 20–24). ~~the~~ The teacher "challenged spaces of Marginality" by giving students a task to prove or disprove if students were being marginalized/ stereotyped (between line 10 & 11 – box). Students drew on multiple resources of knowledge – using a variety of data and representations of data (line 13–14) to support an argument.

How does reflecting on this vignette inform your own practice? What will you take away from this vignette, or what connections can you make to your own teaching or future teaching?

I want to tally how frequently students are corrected behaviorally in connection to their race/ gender/ ethnicity. I know test data is reported with this in mind, however, I want to look for other ways (besides just in testing/assessment) to support equity in my questioning/ lesson planning in class. Students are passionate about equity and it's important to not marginalize based on identities. Students should be affirmed in their identities and supported in my class.

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Identify any **Mathematical Practices** practiced by the students illustrated in the vignette. Provide evidence from the vignette to justify the Mathematical Practices your selected. Please connect your evidence to material/discussions/research discussed in class.

- Students constructed viable arguments - they had to take a stance and back it up with mathematical proof (22-23, 26-27)
- Use appropriate tools strategically: students had to utilize ratios & different representations to back their claims. They also used questioning & letter-writing to connect the math to the real world (13-15)
- Look for & express regularity in repeated reasoning - this whole activity focused on the justification of a claim. As they progressed through different lessons, they had to be able to discuss the evidence. (22-24)

Identify any **Mathematical Teaching Practices** practiced by the teacher that is illustrated in the vignette. Provide evidence from the vignette to justify the Mathematical Teaching Practices you selected. Please connect your evidence to material/discussions/research discussed in class.

- establish goals to focus learning - when presenting the lesson, Mr. C clearly established that their goal was to find actual data & prove (11).
- implement tasks that promote reasoning & problem solving - students had the freedom to choose, but had to decide how their claims could be supported (26)
- build procedural fluency from conceptual understanding - authentic experiences/tasks connected a deep understanding of the school's situation with data analysis.

Which equity-based instructional practices are illustrated (from Aguirre et al. 2013)? What is the evidence from the vignette?

- Affirming math learners' identities - line 24. He considered the racist claim & allowed students to respond. This activity allowed students to engage in a topic they cared about leading to enthusiasm & perseverance.
- Challenging spaces of marginality - pointing out the potential for marginalizing Mexicans (2-5) & refuting it with proof. Gave every student a chance to express their views through letter-writing (line 18)

How does reflecting on this vignette inform your own practice? What will you take away from this vignette, or what connections can you make to your own teaching or future teaching?

I really like how instead of brushing off the conversation with Joaquin, Mr. C takes it to inform his own lesson planning. Knowing what students care about & what interests them is essential for creating connections in the classroom. This is with an authentic activity that actually has clear practical application and covers the necessary procedures. I want to incorporate more of this project-based learning into my classroom.

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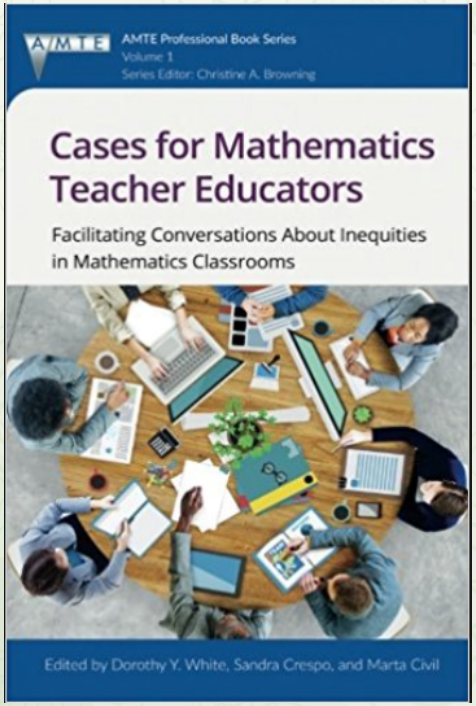
"I really like how instead of brushing off the conversation with Joaquin, Mr. C takes it to inform his own lesson planning. Knowing what students care about and what interests them is essential for creating connections in the classroom. This is such an authentic activity that actually has clear practical application and covers the necessary procedures. I want to incorporate more of this project based learning into my classroom."

# Guidelines for Discussion

1. Keep the conversation grounded in the transcript/video, talk about these children rather than children in general.
2. Use the transcript to ground your comments, questions, or claims.
3. Stay focused on the discussion questions.
4. Assume that students are making sense and that there is knowledge and expertise in what they are saying.

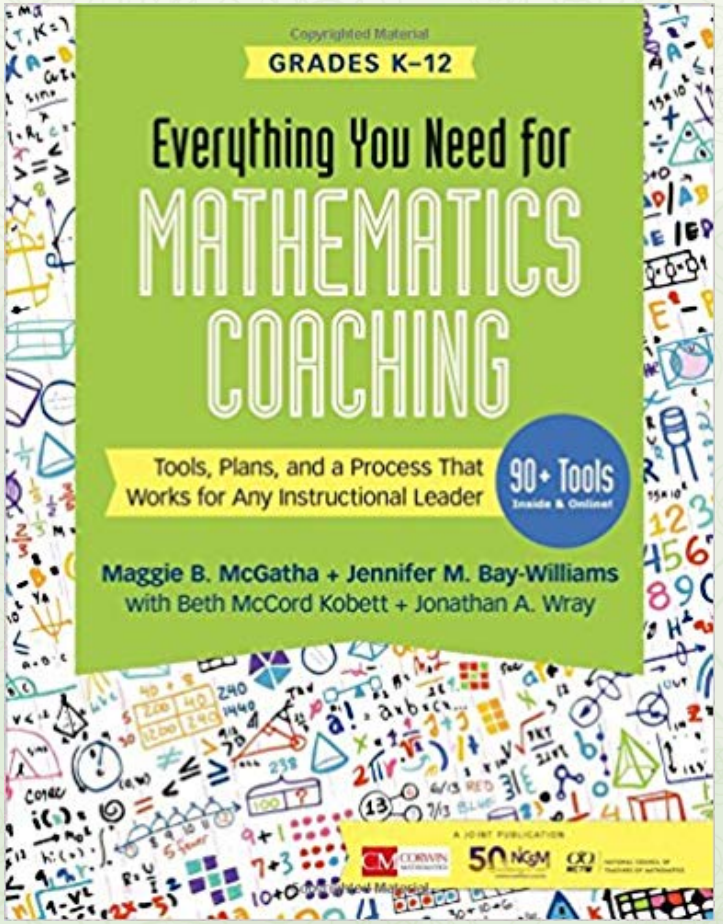



(Moschkovich, 2016, 2016, p. 165)
(adapted from Chèche Konnen Center, TERC)

# Resources

Mathematics Coaching Book, Grades K-12

- Chapter 12 – Presenting Professional Development

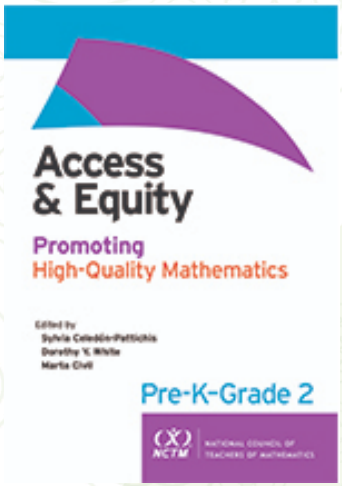


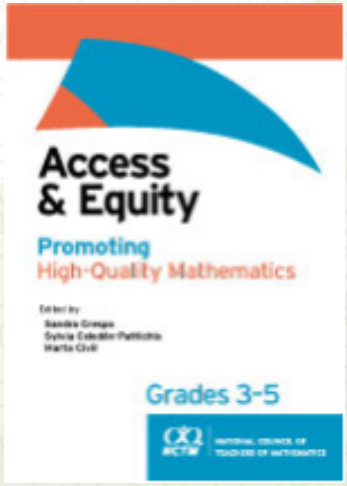
# Questions for Reflection

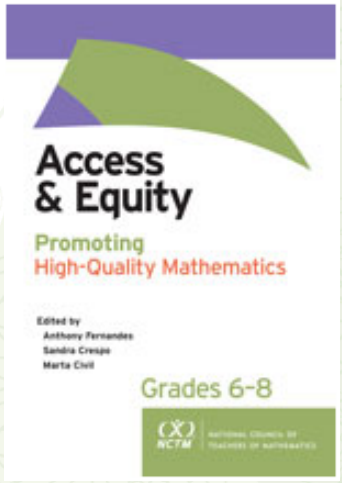
- In what ways have I engaged my students, particularly my students of color, in learning challenging, rigorous mathematics?
- Have I lowered the cognitive rigor of my mathematics tasks? If so, why?
- Am I providing opportunities for my students, particularly my students of color, to discuss and reason mathematically?
- Am I quick to call out certain students for their "bad" behavior?
- Do I have deficit thinking about the parents of my students?
- Have I been dismissive of my students' culture and identity?
- Do I take the time to listen to my students – and not merely respond to their questions?
- Do I acknowledge the assumptions I have about the students in my class?

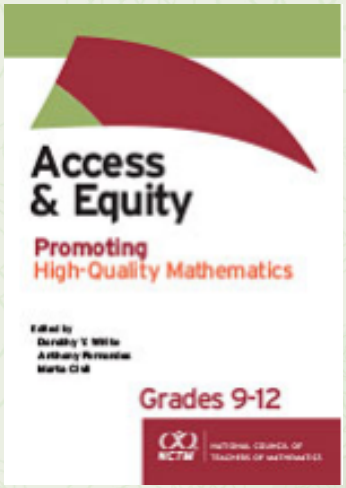
(Jackson & Delaney, 2017, p. 153)

# Access & Equity Series

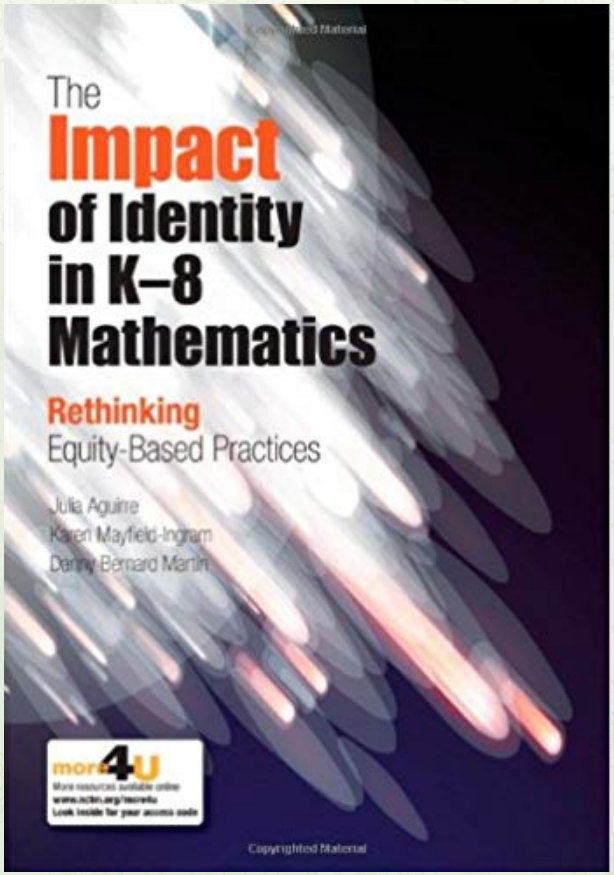


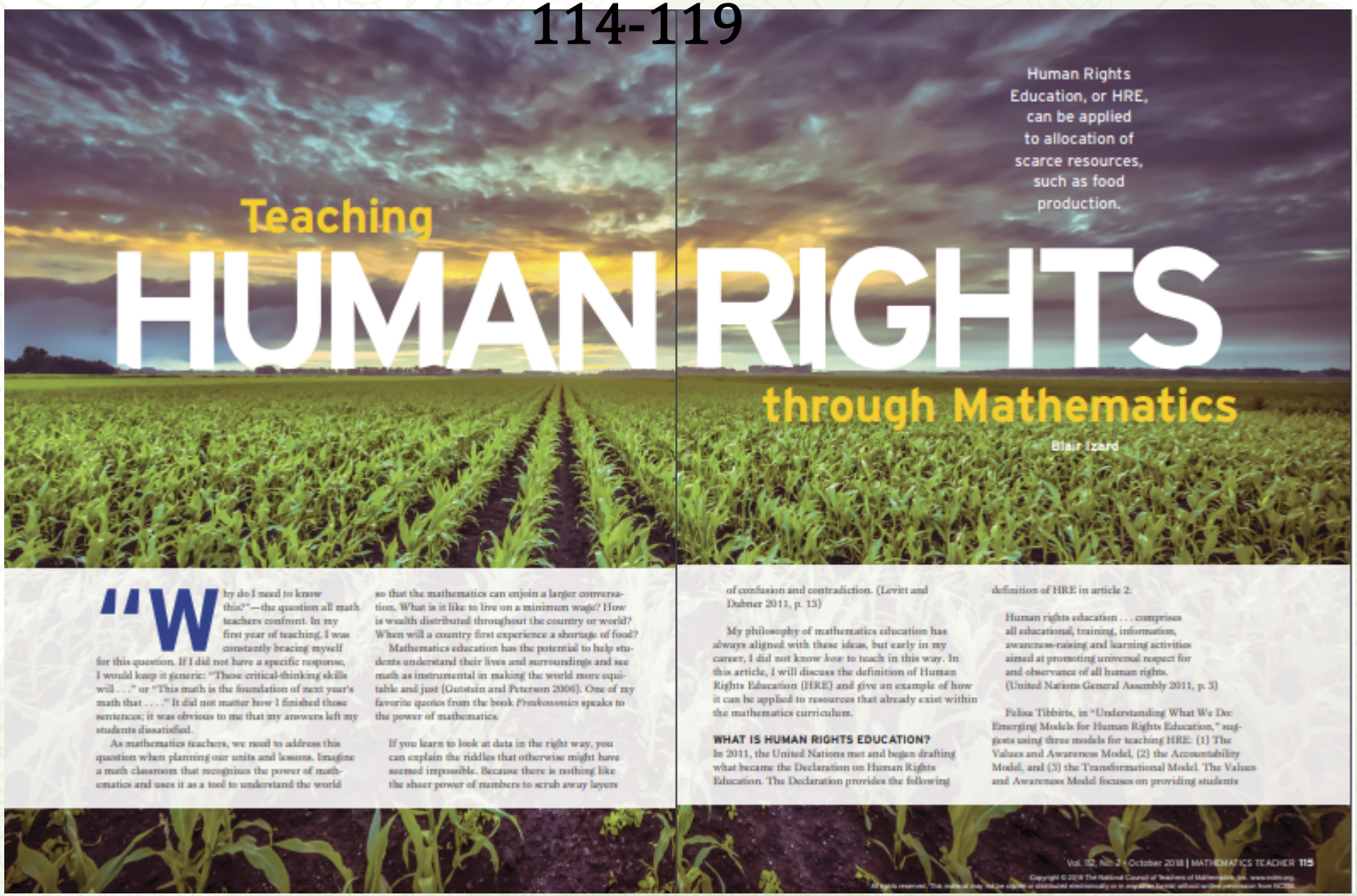




# Impact of Identity in K-8 Mathematics



# Mathematics Teacher, Oct 2018, Vol. 112, No. 2, pp. 114-119



Human Rights Education, or HRE, can be applied to allocation of scarce resources, such as food production.

## Teaching HUMAN RIGHTS through Mathematics

Blair Izard

"Why do I need to know this?"—the question all math teachers confront. In my first year of teaching, I was constantly bracing myself for this question. If I did not have a specific response, I would keep it generic: "These critical-thinking skills will . . ." or "This math is the foundation of next year's math that . . ." It did not matter how I finished those sentences; it was obvious to me that my answers left my students dissatisfied.

As mathematics teachers, we need to address this question when planning our units and lessons. Imagine a math classroom that recognizes the power of mathematics and uses it as a tool to understand the world so that the mathematics can enjoin a larger conversation. What is it like to live on a minimum wage? How is wealth distributed throughout the country or world? When will a country first experience a shortage of food?

Mathematics education has the potential to help students understand their lives and surroundings and see math as instrumental in making the world more equitable and just (Gutstein and Peterson 2006). One of my favorite quotes from the book *Freakonomics* speaks to the power of mathematics.

> If you learn to look at data in the right way, you can explain the riddles that otherwise might have seemed impossible. Because there is nothing like the sheer power of numbers to scrub away layers of confusion and contradiction. (Levitt and Dubner 2011, p. 13)

My philosophy of mathematics education has always aligned with these ideas, but early in my career, I did not know *how* to teach in this way. In this article, I will discuss the definition of Human Rights Education (HRE) and give an example of how it can be applied to resources that already exist within the mathematics curriculum.

### WHAT IS HUMAN RIGHTS EDUCATION?

In 2011, the United Nations met and began drafting what became the Declaration on Human Rights Education. The Declaration provides the following definition of HRE in article 2:

> Human rights education . . . comprises all educational, training, information, awareness-raising and learning activities aimed at promoting universal respect for and observance of all human rights. (United Nations General Assembly 2011, p. 3)

Felisa Tibbitts, in "Understanding What We Do: Emerging Models for Human Rights Education," suggests using three models for teaching HRE: (1) The Values and Awareness Model, (2) the Accountability Model, and (3) the Transformational Model. The Values and Awareness Model focuses on providing students

# Mathematics Teaching in the Middle School, March 2016, Vol. 21, No. 7, pp. 398-405

Kasi Allen and Kemble Schnell

## DEVELOPING Mathematics Identity

*Strategies are offered to help teachers support the emergence of their students' math identities.*

Don't let the noise of others' opinions drown out your own inner voice.

—*Steve Jobs, Stanford University commencement speech, 2005*

Many middle school students approach math with caution, often trepidation, and generally less-than-complete confidence. Several factors contribute to their views of what math actually is (a system of rules to follow and formulas to apply) as well as who might be good at it (people who can see the path to an answer and calculate quickly). A few tell us they "just aren't math people"—something we know to be false. Students at this age are immersed in forming their identity, including their mathematics identity. At a time when they might be embracing math as a powerful tool for reading their world, young people can instead succumb to fixed mindsets, the perpetuation of math myths, and a compromised relationship with math, thus affecting their school and career trajectory for the rest of their lives. Middle school math teachers have a unique opportunity to steer their students' mathematical development in a more positive direction.





# Mathematics Teacher, Nov 2015, Vol. 109, No. 4, pp. 256-260

# Talking Circles Promote Equitable Discourse

*A structured discussion format disrupts patterns of stratified talk and facilitates broader student participation.*

Marcus Hung

ORLANDO ROSUTHINKSTOCK

Teachers facilitate math talk in the classroom, but introducing a structured discussion format called the *talking circle* can influence opportunities for equitable student participation. Drawing on my reflections over the 2013–14 academic year and reviewing my detailed teaching notes and lesson plans, I take a close look at the structure of the talking circle and compare it with that of two other discussion formats that I commonly use in my classroom—traditional whole-class discussions and small-group discussions. I explore a mechanism that can potentially disrupt patterns of stratified classroom talk, with tradeoffs between frequency and spontaneity of student contributions. I hope teachers can use this information to begin experimenting with talking circles in their classrooms, finding versions that fit their school culture, and to reflect critically on the issue of promoting equitable classroom discourse.

Education scholars increasingly embrace the definition of *equity* as the equal or fair distribution of opportunities to learn (e.g., Esmonde 2009). Adhering to this definition, I focus on equitable classroom discourse that involves equal access to participation for all students across all public conversation formats.

Suppose that only the same three or four students contribute regularly to traditional whole-class oral discussions, a format in which the teacher organizes participation in large part by calling on students. The teacher's facilitation, combined with the students' automatic behaviors, may unwittingly result in a type of stratified classroom talk (more on this later) that constrains opportunities for all students to experience themselves as full participants in the mathematical discourse and reifies status hierarchies. *Stratified classroom talk* is the conversational pattern whereby, over time, certain students contribute more frequently than all other students to public discussions. I do not intend to place a value judgment on this classroom phenomenon per se. However, I consider it not optimal for learning for all students because of its tendency to reproduce social-status hierarchies and its effect on student identity—that is, how students see themselves as doers of mathematics.

In my classroom community, students who identify strongly as mathematically competent tend to volunteer and contribute most frequently to whole-class discussions. These same students also demonstrate higher achievement on assessments and classwork throughout the school year. Conversely, students who do not perceive themselves as doers of mathematics—according to their journals, written surveys that I conduct throughout the year, and my ongoing personal conversations with students—tend to contribute less frequently during whole-class discussions, if at all. There are one or two exceptions to this trend, but it generally holds true. When I consider the class as a whole, my underlying assumption is this: Students' self-perceptions, patterns of participation in whole-class discussions, and achievement and learning outcomes are linked and influence one

# Questions?

# Thank you!

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