Strength in Numbers:
Building towards Justice in Mathematics Education
Empowering Minds:
Culturally Sustaining STEM as Literate Practices Conference

Benjamin Dickman [@benjamindickman]

Mathematics Teacher | Elmhurst University STEM Teaching Conference

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Register. Plan. Vote. Count.

https://www.vote.org/

Election Day is on Tuesday, November 3, 2020.
We may not know the results on Election Day.

Election Protection: Know your Rights as a Voter

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theory—practice divide

What does it mean to offer "practitioner-based suggestions"?

What does it mean to find "educators willing to collaborate and conspire"?

Who is actually engaging in social justice mathematics as opposed to either mathematics with social justice as an add-on, or mathematics without social justice at all?

(To some extent) I do not know.

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Theorem 1.
The current model of education in the United States of America is not sustainable.

Corollary 2.
The current model of education in the United States of America will change.

Open Problem 3.
Who will be part of the change and in what roles?

"presentation on #DisruptMaths"

Workshop Invitation for STEM Professional Development- October 17, 2020 — Inbox ×

Ayanna Brown ~~[redacted]~~

to me

Tue, Sep 15, 11:29 PM

Dear Dr. Benjamin,

My name is Ayanna F. Brown, and I am an Associate Professor of Education at Elmhurst University. I had the pleasure of learning about your research and praxis and was truly engaged in examining your presentation on #Disruptmaths. I am writing to respectfully request your consideration to participate in a professional development virtual conference on STEM education with a focus on Culturally Responsive Learning conference entitled: *Empowering Minds: Culturally Sustaining STEM as Literate Practices*. The conference is scheduled for Saturday, October 17, 2020. This professional development will be hosted remotely on the Zoom platform and is designed specifically for area middle school and secondary STEM educators.
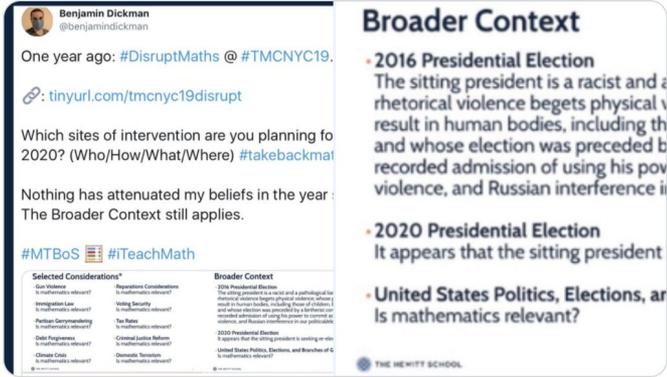
Below is a description of what we are organizing for October 17, 2020.

The mark at the bottom of these slides indicates my present employer.

I speak strictly on behalf of myself.

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Tweet

Hey @hewittschool This is your math teacher? Seriously? This is appropriate? .... there's your mark at the bottom, you endorse this?

Benjamin Dickman @benjamindickman

One year ago: #DisruptMaths @ #TMCNYC19.

🔗 tinyurl.com/tmcnyc19disrupt

Which sites of intervention are you planning fo 2020? (Who/How/What/Where) #takebackmat

Nothing has attenuated my beliefs in the year The Broader Context still applies.

#MTBoS 📋 #iTeachMath

Broader Context

- **2016 Presidential Election**
  The sitting president is a racist and a rhetorical violence begets physical v result in human bodies, including th and whose election was preceded b recorded admission of using his pov violence, and Russian interference i

- **2020 Presidential Election**
  It appears that the sitting president

- **United States Politics, Elections, ar**
  Is mathematics relevant?

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9:52 AM · Aug 18, 2020 · Twitter for iPhone

@terror~~[redacted]~~ · Aug 18
Replying to ~~[redacted]~~ and @hewittschool
Dudes name is Benjamin Dickman???
💬 1

· Aug 18
Mr. Dickman has no qualms about injecting politics in math class, and neither does his employer
💬 1

@terror~~[redacted]~~ · Aug 18
So many truly terrible people in the "business" of education
💬   ♡ 1

"is anyone teaching math through a social justice lens?"

- **Originally tweeted by an education reporter:**
  October 5

- **Amplified by a Harassment Influencer:**
  October 12

Notice? Feel? Wonder? Act?

ten current/recent classroom educators on twitter

@_b_p
@DingleTeach
@ESMathTeacher
@HKhodai
@Idil_A_
@jennalaib
@melvinmperalta
@mpershan
@samjshah2
@xyu119

one webinar:
TODOS, <u>Rights of the Learner</u> from **@OlgaGTorres1**

one group:
@GlobalMathDept

(How do we cite and not incite?)

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this is not what I mean by justice in (school) mathematics

- Students will learn about elliptic-curve cryptography and ransomware in order to target the financial holdings of U.S. Immigration and Customs Enforcement (ICE) agents.

- **Why not cover this? Aren't you trying to #AbolishICE?**

- This is extremely illegal and I do **not** support teaching this in our classrooms.

or

- Students will apply concept from mathematical physics to investigate optimal methods for toppling and destroying statues of confederate figures.

- **Why not cover this? What happened to tearing down racist symbols?**

- This is extremely illegal and I do **not** support teaching this in our classrooms.

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a thought experiment (i) Social Justice in Statistics

- Who takes statistics courses in a typical K–12 mathematics education trajectory?

- What is the average (median? mode?) number of statistics courses taken in 13 years?

One step further.
Consider a course on statistics whose goal is to research real-world statistical phenomena.

Suppose you have students investigate wait time outside of MEN and WOMEN restrooms.

What will students learn?

What will students do?

What will teachers learn?

What will teachers do?

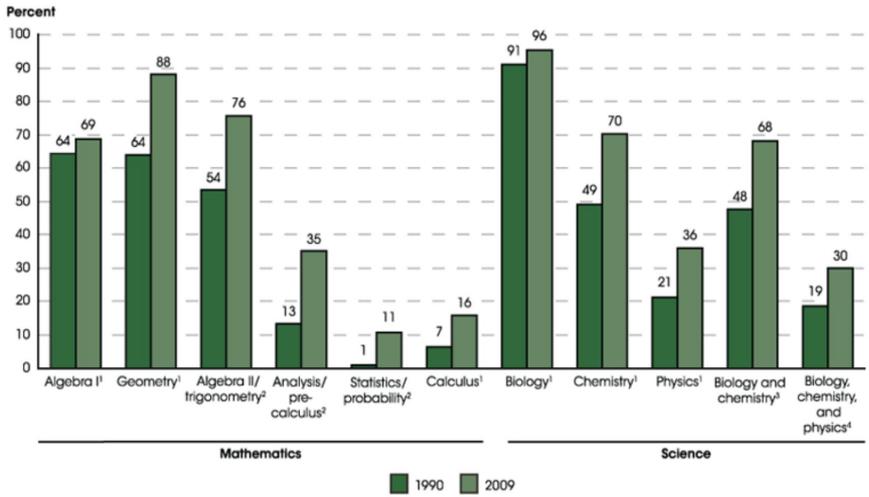**Notice Feel Wonder Act**

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a thought experiment (ii) Social Justice in Statistics

- Who takes statistics courses in a typical K-12 mathematics education trajectory?
- **Very few students.**

- What is the average (median? mode?) number of statistics courses taken in 13 years?
- **Zero.**

One step further?

Where is the justice?

Where is the action?

What are students learning?

What are teachers doing?

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I'm just a non-binary student, standing in front of my statistics professors, asking them to use any other example than sorting populations by men vs. women

11:30 AM · Oct 15, 2020 · Twitter Web App

317 Retweets   **27** Quote Tweets   **3.8K** Likes

IES NCES National Center for Education Statistics ☰ MENU   Search Go

Percentage of high school graduates who completed selected mathematics and science courses in high school: 1990 and 2009

Percent

Course	1990	2009
Algebra I[1]	64	69
Geometry[1]	64	88
Algebra II/trigonometry[2]	54	76
Analysis/pre-calculus[2]	13	35
Statistics/probability[2]	1	11
Calculus[1]	7	16
Biology[1]	91	96
Chemistry[1]	49	70
Physics[1]	21	36
Biology and chemistry[3]	48	68
Biology, chemistry, and physics[4]	19	30

Mathematics   Science

■ 1990   ■ 2009

building towards justice in (school) mathematics

- Who are You? **identity/math identity**

- What do mathematicians do? **play/productive struggle**

- Where is math from? **many cultures/places over time**

- What is labeled as 'math'? **social conventions/-isms**

more information at:
Algebra 2: Public Unit Design Framework [Dickman]

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building towards justice in (school) algebra

- Who are You? **identity/math identity**
  - Students will reflect on how **naming** works in the context of mathematics and, in particular, on **their own names**.
  - **Absolute Value Functions**

- What do mathematicians do? **play/productive struggle**
  - Students will reflect on the behaviors of mathematicians and, in particular, center **mathematical play** and **productive struggle** rather than calculating and memorizing.
  - **Quadratic Functions**

- Where is math from? **many cultures/places over time**
  - Students will see that mathematics **emerges over time** and **from all corners of the world**, yet these **histories** are often ignored in the context of school mathematics.
  - **Quadratic Formula**

- What is labeled as 'math'? **social conventions/-isms**

for those who scaremonger around a loss of 'rigor'

+   ↶ ↷   ⚙ «

1   "   Press play on h and k and see what happens!   ×

2   ▶ $h = 7$ ×
   ⇄   0 ———————●———— 10

3   ▶ $k = 5.76$ ×
   ⇄   0 ————●———————— 10

4   ▣   ▼ M   ×

5   🔴 $y - k = -\left|4|x - h - 2| - 4\right| + 4\{y - k \geq 0\}$ ×

6   ▣   ▶ A   ×

9   ▣   ▶ T   ×

12   ▣   ▶ H   ×

16   ▣   ▶ Bouncy Walls   ×

what does this course actually look like for students?

Introducing Ourselves and Our Course
An introduction consisting of our names, some of the technology that we will use, the first function family that we study this year, and a preview of our first project.
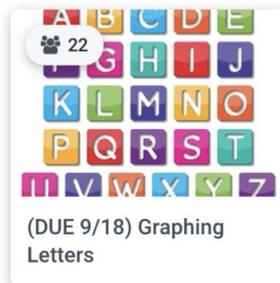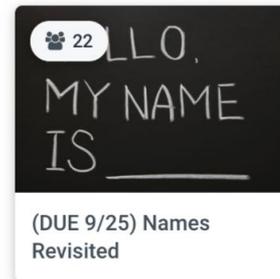
(DUE 9/16) My Name Is . . .

(DUE 9/18) Desmos? Absolutely!

(DUE 9/18) Graphing Letters
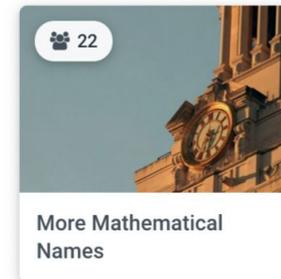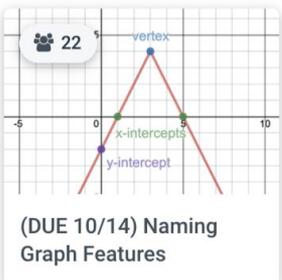
(DUE 9/25) Names Revisited
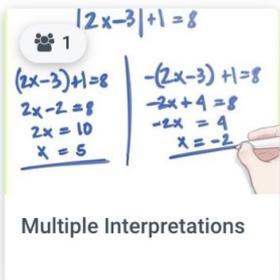
More Mathematical Names

Deepening Content Knowledge
We look at multiple interpretations of absolute value functions, learn to name some common features of absolute value functions, and then (as desired) stretch ourselves with non-routine absolute value problems.

(DUE 10/14) Naming Graph Features

Multiple Interpretations

Solving Problems

Solving Non-Routine Problems

Worked Examples by Request

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Unit 1 Title: What's in a name?		
Unit Summary	**Big Ideas**	**Mission Alignment**
This unit asks students to reflect on how naming works in the context of mathematics and, in particular, on their own names. *Students will engage with absolute value functions and absolute value inequalities, as well as sliding parameters and function restrictions, to create an animated graph of their own names. Familiarity with the graphing tool used, Desmos, will position students to pursue increasingly rich topics throughout the year.*	*Names are important — whether they are the names of people in our class, people who are included in traditional canons, or people whose names are broadly recognized in mathematics — and we should question how the process of naming functions.* *Familiarity with digital graphing tools, such as Desmos, is an essential skill, and a strong foundation early in the year will facilitate subsequent growth.* *Absolute value functions, and piecewise defined functions more generally, provide a new and important way of visualizing mathematics.*	*Students will grasp more deeply how naming practices relate to equity and ethics, and will engage with a dynamic graphing tool in a joyful manner. Moreover, we will begin the year with a way of learning about one another and centering humans within our mathematical understanding, which will build towards a sustainable community of learners as we forge ahead with our continued learning.*

Stage 1: Desired Results

Standards (Learning Objectives)

Mathematical Content Standards:
- Students will be familiar with [Desmos](#)
  - Write and understand functions of the form f(x) = a|x − h| + k
  - Know how the parameters a, h, and k affect absolute value functions/graphs
  - Connect understanding of absolute value functions to knowledge of linear functions
  - Predict what a visual representation (graph) of an absolute value or inequality will look like based on its symbolic representation (function equation) and vice-versa
  - **EI:** Explore nested absolute value functions and other nonstandard avf problems
 	
Teaching Tolerance [Standards](#):
- Students will focus primarily on Identity standards ID.9-12.1–5
- Students will focus secondarily on Diversity standards DI.9-12.6–10

Understandings	Essential Questions
Names reflect the cultures in which they were created and assigned, and their continued presence or erasure provide contexts for exploration. *Names are an important part of a person's identity, and there are biases that marginalize individuals based on their names.* *Mathematics, and algebra in particular, should involve the understanding of patterns and the quest to connect multiple representations; essential among these is the connection of visual and symbolic representations.* *Absolute value functions are a new class of functions, which can serve both an aesthetic purpose (e.g., through an art project) as well as an object for unpacking (e.g., identifying traits such as concavity, vertex, slopes, intercepts).*	*Where do names — "algebra" or "Pythagorean Theorem" (or "Fermat's Last Theorem") or "Roman vs Arabic Numerals" or "Cartesian Plane" — come from, and what do they signify, in mathematics?* *What is the origin of my own name, and what are the meanings that a person's name can hold for themselves and their families, as well as the biases that can arise when names are read by others?* *What are the ways in which visual representations and symbolic representations can be connected and expressed, and how can knowledge of mathematical function types build capacities to express ourselves aesthetically?* *For the particular function type known as an absolute value function, what are the traits by which we can characterize these functions, and how can we move effectively between their visual and symbolic representations?*

Knowledge (Know)	Skills (Do)
Where are some of the sources for the names that we have encountered in mathematics? *What does my own name mean, and what impact do names have in real-world contexts?* *What are some of the ways in which we can harness technologies and mathematical understanding to create aesthetically pleasing and personally meaningful products?* *As we build up our knowledge of mathematical functions, what are the ways in which a function can be characterized according to its symbolic or visual representation?*	*Students will be able to read about etymology and curiosity around name origins will be piqued.* *Students will explore their own name history as best as they can, and read about the ways in which biases are reflected in the real-world when, for example, prospective employers racialize or gender job applicants' names. Supporting materials: [1](#), [2](#), [3](#), [4](#)* *Students will familiarize themselves with Desmos graphing software, and create a graph of their own name that bounces around within a predefined region by modifying parameters and using function restrictions. [Sample](#).* *Students will be able to move between symbolic and visual representations of absolute value functions and inequalities based on: concavity, vertex, y- and x-intercepts, increasing and decreasing intervals, domain and range.*

Phase 2: Determine Acceptable Evidence of Understanding

Assessment Evidence of Student Understanding	
What evidence will show what students understand?	
Performance-Based	**Other Evidence**
	(quizzes, prompts, work samples, observations, student self-assessment and reflection)
Written Response *(accompanying personalized graph):* *Consider the following graph of the word MATH:* https://www.desmos.com/calculator/atzno2qtaa *Clicking play on h and k will make the word MATH bounce off of the walls.* *Your assignment is to create a graph that does the same, but to use your name rather than the word MATH. Please use at least one absolute value function (this may require some creativity, depending on the letters in your name!). In your submitted write-up of 2-4 pages, you will be asked to reflect on your own name story as well as to describe the process that you went through in creating your Desmos graph.* *Relevant Media:* 1) *Name Stories* 2) *Names Do Matter* 3) *Facundo the Great* 4) *Anti-Black hiring Discrimination*	Work samples *to see whether students can effectively move between the representations of absolute value functions using symbols and graphs, and identify importance of parameters in y = a|x–h| + k function equation presentation.* Prompts *to investigate the history of mathematical names, as well as to find a contemporary example of a name that was changed; the latter need not be strictly mathematical, although STEM examples will be preferable. For example, UT Austin is* renaming *its* Robert Lee Moore *Building to the Physics, Math and Astronomy Building. Why? Another example is the* renaming *of the* R.A. Fisher *Award in statistics. Why?* Reflection *on the names that are familiar from school mathematics (e.g., Euclid, Pythagoras, Newton, Archimedes, Einstein, Descartes). What other names are* out there*?* Quizzes *that involve solving non-routine absolute value problems. (Note: Some problems can be found in our* problem set *from past years.)*

Post-Unit Reflection:

S: Reflect: What went well with unit one? What would you like to see change or stay the same as we move ahead?

Theorem 1.
The current model of education in the United States of America is not sustainable.

Corollary 2.
The current model of education in the United States of America will change.

Open Problem 3.
Who will be part of the change and in what roles?

developing ideas about justice in (school) mathematics

- Who are You? identity/math identity

- What do mathematicians do? play/productive struggle

- Where is math from? many cultures/places over time

- What is labeled as 'math'? social conventions/-isms

What could this look like in your (school) math work?

How can we collaborate and build towards justice?

(To some extent) I do not know.

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thank you all

Questions? Comments? Ideas? Other?
Reminder: *Register. Plan. Vote. Count.*

Benjamin Dickman [@benjamindickman]

Mathematics Teacher | Elmhurst University STEM Teaching Conference

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