

Equitable Mathematics Instruction: What Do Teachers Need to Do – and Therefore Know and Care About?

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Three assumptions*

1. Mathematics is an important resource for participation in a democratic society, education, and career options, and hence ought to be a core school subject.
2. Big differences in effectiveness with different groups of students: unequal opportunities and outcomes.
3. Teaching can have powerful effects on students' opportunities and outcomes.

***each of which is subject to critique and challenge**

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Three fundamental questions

1. What is the appropriate "content," and why?
2. What is "good teaching"?
3. What "knowledge" is needed for equitable mathematics instruction?

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1. What is the appropriate "content," and why?

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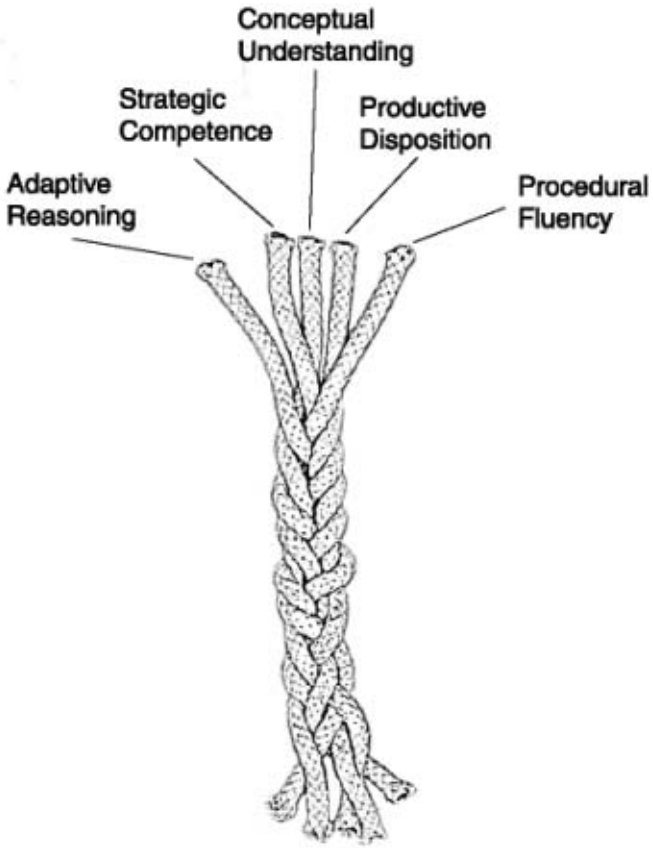
What is the content, and why?

- Mathematics as tools used for social and political analysis and critique
- Mathematics as a cultural product, and the importance of studying mathematics of other cultures and times
- Mathematics as practiced in "the" discipline

Claim: There are affordances and problems with each.

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What is "knowing" math?



- ***Conceptual understanding*** - comprehension of mathematical concepts, operations, and relations
- ***Procedural fluency*** - skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- ***Strategic competence*** - ability to formulate, represent, and solve mathematical problems
- ***Adaptive reasoning*** - capacity for logical thought, reflection, explanation, and justification
- ***Productive disposition*** - habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy

+ Mathematical language

Kilpatrick, J., J. Swafford, and B. Findell. (2001). *Adding It Up: How Children Learn Mathematics*. Washington, DC: National Academy Press.

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What do we mean by "language" in mathematics?

Isn't math just numbers, symbols, formulas, graphs, and calculations, mostly bereft of text?

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{4a}$$

$x^2 - y^2 = (x + y)(x - y)$

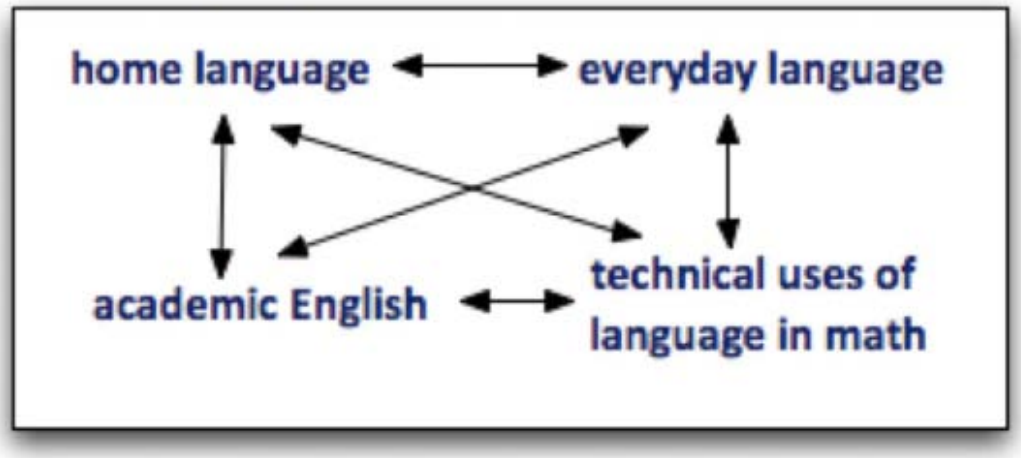
NO!

1. Mathematics uses three forms of linguistic tools: Words, symbols, and diagrams.
2. These are <u>all</u> forms of text.
3. Doing mathematics requires reading, writing, speaking, and interpreting these.

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Learning mathematics requires making linguistic transitions

- Language
- Vocabulary, grammar, syntax, talk (how language is "delivered")
- Discourse
- Learners must navigate among everyday language, academic English, home language, and technical uses in mathematics.



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2. What is “good teaching”?

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What is "good teaching"? Multiple perspectives

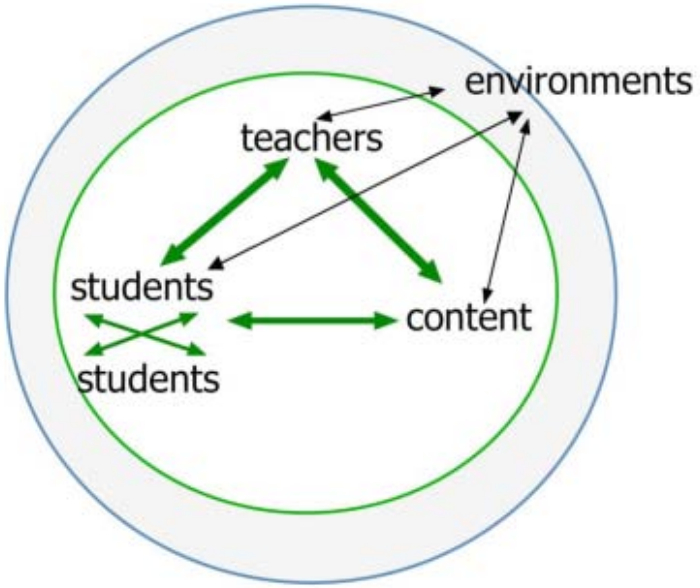
1. Good teaching = good teaching for all.
2. Good teaching = good teaching, but some practices of teaching are especially important when teaching students from non-dominant groups.
3. "Good teaching" is actually not always good teaching for all; sometimes further exacerbates inequities.
4. Good teaching requires culturally specific practices.

Claim: These each have validity for particular practices; no single answer.

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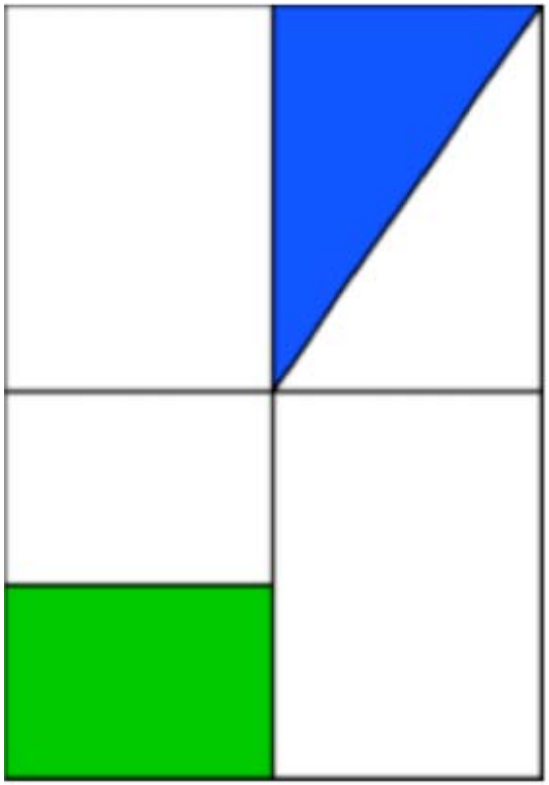
What is “teaching”?

- Teaching is what is co-produced by students and teachers in contexts, around specific content and curriculum
- Teachers are the ones uniquely responsible for increasing the probability that students learn important content and skills, and gain at least a school year’s worth each school year
- This is intricate and unnatural work that requires deliberate design and unnatural kinds of attention and thinking



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The task

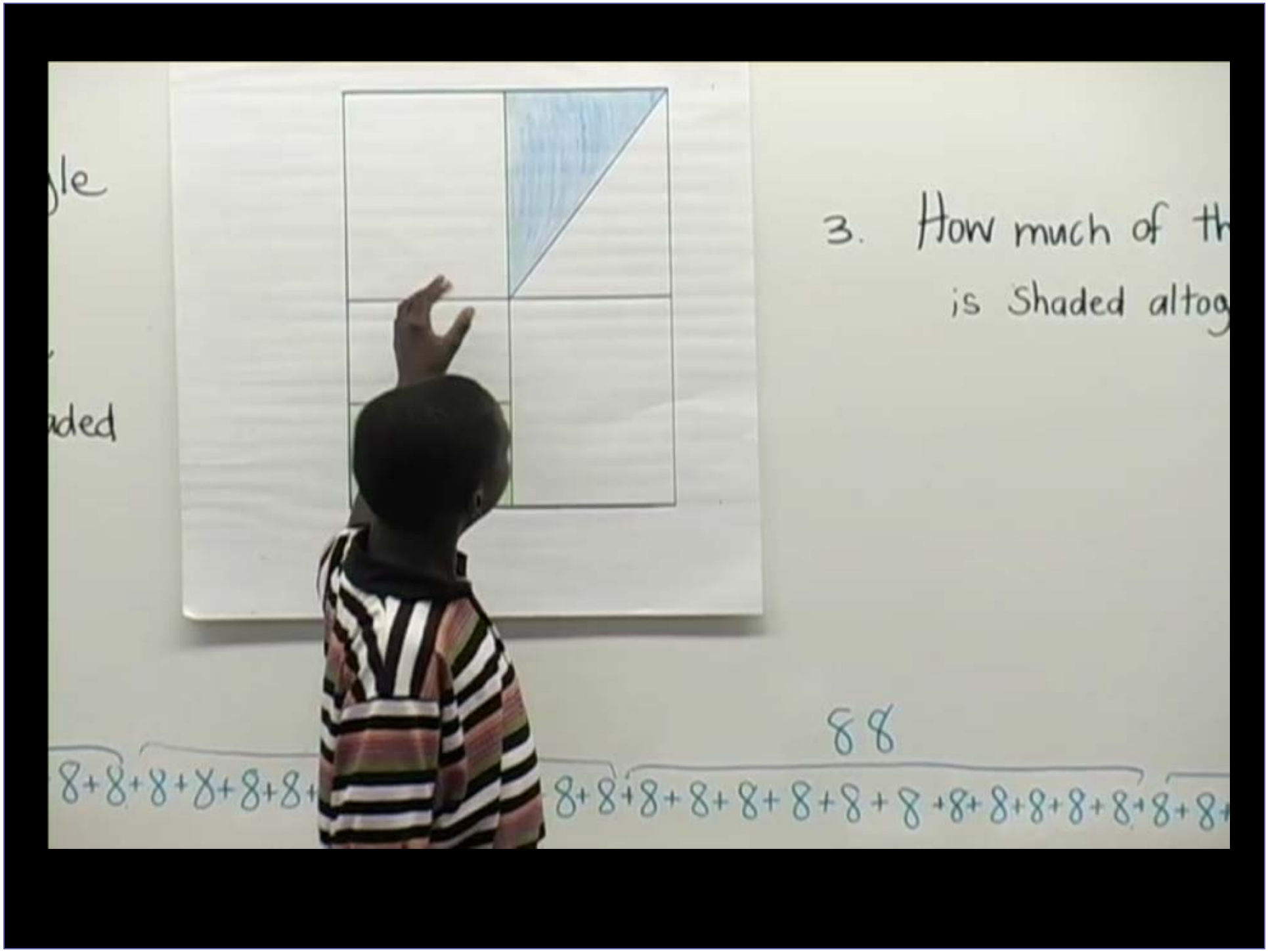


What fraction of the big rectangle is shaded blue?

What fraction of the big rectangle is shaded green?

What fraction of the big rectangle is shaded altogether?

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Dilemmas of attending to teaching

1. Lack of attention to teaching
   - Value-added measurement that fails to investigate variation in teaching practices
   - Orientation to "constructivist" or "student-centered" classrooms
   - Belief in teaching as highly improvisational and largely unspecifiable
2. A confounded view of "professionalism"
   - Agreement on the complexity of practice
   - Disdain for "prescriptiveness" and detail: "de-skilling" teaching (an irony)

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Key practices of equitable mathematics instruction

1. Expecting and enabling complex mathematical work of each student
2. Coordinating mathematical, school, and students' language
3. Using contexts with sensitivity to students' funds of knowledge and to the integrity of the mathematics
4. Creating a respectful mathematically-focused learning environment

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Example: Enacting high expectations in mathematics instruction

1. Broaden what it means to be successful in math class
2. Make mathematical practices explicit
3. Support students' mathematical work both publicly and privately
   - Listen carefully to students' talk
   - Notice and improve ambiguous talk
   - Ask mathematical questions
4. Teaching students to be "people who study mathematics"

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3. What "knowledge" is required for equitable mathematics instruction?

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Essential resources

1. Mathematical knowledge for teaching
2. Ability to see, hear, and learn about students and their environments as these relate to mathematics, broadly and clearly construed
3. Sensitivity to language
4. Practices of bridging between students' resources and school mathematics

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More than — AND — "knowledge"

- Teaching is a practice, and so what matters is what teachers can do, care about, be like – as well as "know."
- Teaching mathematics equitably demands skill, commitment, beliefs — and knowledge (case of MKT).

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