HOW CAN WE ADVANCE TEACHING? IMPROVING STUDENTS' LEARNING THROUGH HIGH-LEVERAGE PRACTICES OF INSTRUCTION

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Pathways National Forum • Santa Cruz CA

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SCHOOL OF EDUCATION
UNIVERSITY OF MICHIGAN

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KNOWING MATHEMATICS . . .

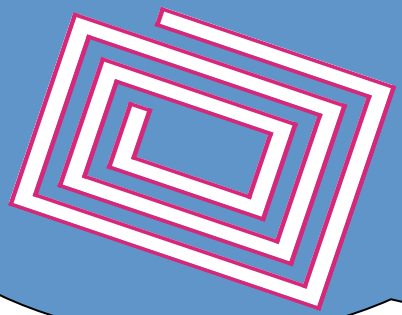
What is the average number of hours of vigorous exercise that people in this room engage in per week?

How many different ways can change be made for a dollar?

Is 1 a prime number?

What is $7 \div 0$?

Is this a polygon?



. . . involves learning and doing for <u>oneself</u> . . .

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TEACHING MATHEMATICS

Involves getting others to know, do, and think with mathematics,

which requires knowing, doing, and thinking with math well oneself.

BUT— this is necessary, and not at all sufficient.

Why?

Because we only succeed if our students succeed.

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IMPROVING STUDENT OUTCOMES: WHAT DOES IT TAKE?

- Redesign of curriculum
- Changes in organization
- **Developing teaching practice**

What makes this often difficult?

- Isolation
- Underdeveloped professional language
- Strong cultural belief in creativity, individualism, context

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STUDENTS ARE THE POINT

1. Skillful teachers must be focused on and interested in other people's thinking, learning, and work in the domain, not only their own.
2. Teachers cannot learn for their students
3. Students do not necessarily learn or think the same as their teachers.

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WHAT DOES THIS IMPLY?

- We must have access to what our students think.
- Our students have to know what they think and be able to hold on to it in practice.
- That we teach in classes means that we should use the collective setting as a crucial resource for focusing on student thinking.

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TEACHING FOR STUDENT LEARNING

What are specific things that the teacher is doing to focus on students' thinking about the mathematical ideas?

Video of QW 2.6

youtu.be/uqHrhCMkT1o

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FOCUSING ON STUDENT LEARNING

- Trying to express the core idea ("central tendency" of a data set) in terms that make sense to students: *talking with learners in mind*
- Reviewing basic calculation of mean, median, mode to check for understanding
  - *Choosing numbers strategically with learners in mind*

    (a) 13, 18, 13, 14, 13, 16, 14 (b) 1, 2, 4, 7

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FOCUSING ON STUDENT LEARNING IN A WHOLE GROUP DISCUSSION

What are specific things that the teacher is doing in this segment to **focus** on students' thinking about the mathematical ideas?

- Anticipating
- Eliciting
- Interpreting and responding
- Using

Video of QW 2.6 segment #2

youtu.be/uqHrhCMkT1o

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ELICITING STUDENT THINKING: THREE FORM EXAMPLES

1. Asking students to explain (their own or others') answers or solution methods.
2. Reversing roles: asking students to pose a question that would show whether someone else understood.
3. Perturbing student thinking.

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ASKING STUDENTS TO EXPLAIN SOLUTIONS

- How did you get the mean of 14.4 for the set 13, 18, 13, 14, 13, 16, 14?
- Could you describe a situation for which these data and mean would make sense?
- Pay got a mean of $14\frac{3}{7}$. How do you think Pay got this answer?

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REVERSING ROLES

- Make up a dataset and a question that you think would tell you whether someone else understands what a mean is and how to calculate it.
- How would you explain or show a fifth grader what the mean of a set of data is?
- If someone told you that the mean of the data 12, 15, 6, 10, and 7 was 10, what would you ask that person to see whether he or she understood what a mean is?

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PERTURBING STUDENT THINKNG

Example:

Lamed: The set of numbers 1, 2, 4, and 7 has a mean of 3.5, but no mode.
Mem: It also has no median.
Do you agree or disagree with Lamed? Or Mem?

Perturbing student thinking is an unnatural practice.

- It seeks to provoke and unsettle students' thinking.
- It presents students with confusions rather than warding them off.

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SKILLFUL TEACHING IS UNNATURAL AND INTRICATE WORK

1. Teaching requires teachers to do things that are not common sense.
2. Teaching involves some moves or orientations that are unnatural in regular adult life.
3. Teaching practice is intricate, requiring a complex combination of knowledge, skill, timing, and relational work.

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THE DILEMMA OF TEACHER INCENTIVES

- If we can only really succeed if our students succeed, then:
  - The incentives are strong to believe our students are doing well and are "getting it."
  - Students often say things that sound right, but might mean those differently from what we mean or know when we say them.
  - For very good reasons, we are inclined to hear our students as understanding.
- It takes a lot of courage to lift the cover on student thinking.

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HIGH-LEVERAGE INSTRUCTIONAL PRACTICES

High-leverage practices (HLPs) are core capabilities that powerfully promote learning and are fundamental to skillful teaching.

Based on work done at the University of Michigan School of Education in the redesign of our teacher education program, and at TeachingWorks, a new organization whose mission it is to improve the quality of teaching and learning by transforming teachers' education.

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THREE HIGH-LEVERAGE PRACTICES TO FOCUS TEACHING ON LEARNING

① Eliciting and responding to student thinking

② Using student ideas in a discussion

③ Developing norms central to mathematical work

What do these have in common?

Each gives the teacher access to student thinking and also supports students in developing their thinking.

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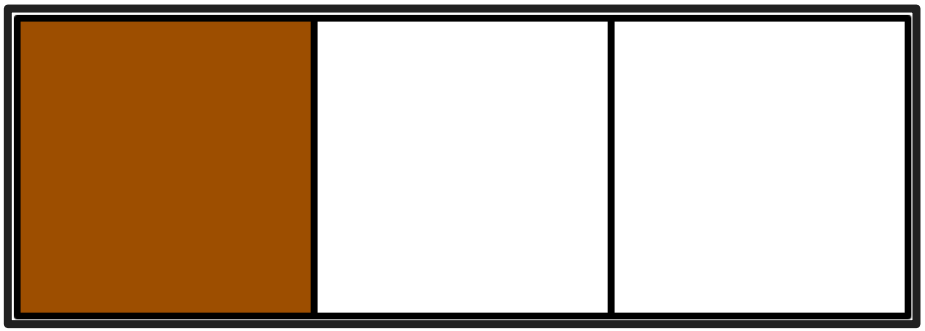
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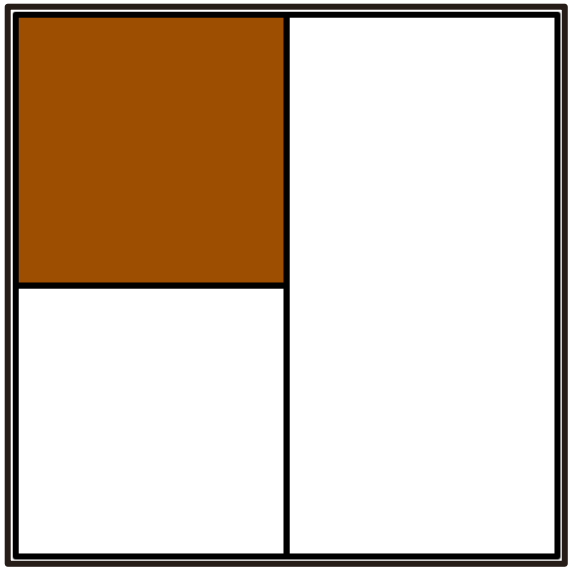
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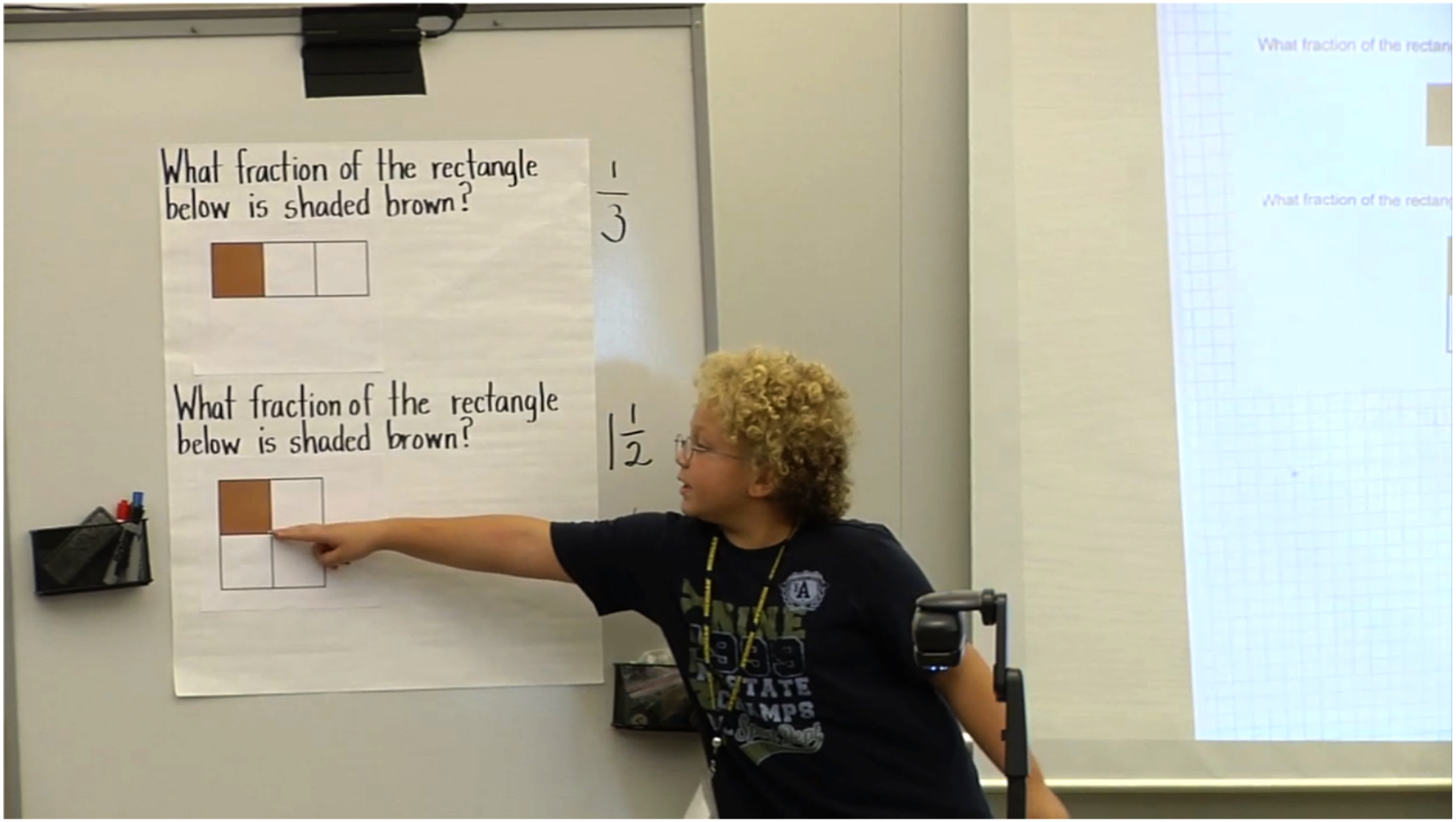
HOW MUCH OF THE RECTANGLE IS SHADED BROWN?





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FOCUSING ON STUDENT THINKING REQUIRES BREAKING WITH STUDENTS' PAST SCHOOL EXPERIENCE

- Using problems designed to elicit common patterns of student thinking
- The use of student "error" as a productive mathematical work
- Developing norms that mathematical ideas come from fellow students and not just the teacher

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WRAP UP

How can we truly advance teaching?

1. Students are the point, and they are not us.
2. Understand that our incentives do not run in the direction of the core work of skillful teaching.
3. Making classrooms places that focus on student learning requires breaking with students' past school experience (and our own).

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