IMPROVING STUDENTS’ LEARNING:
KEEPING OUR FEET ON THE ACCELERATOR
AND OUR EYES ON THE REAR-VIEW MIRROR

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THE URGENCY

1. Enormous gaps in learning opportunities and disparities in achievement (within U.S. and in international comparisons)
2. Rapidly changing school population
3. Higher, more complex academic goals
4. High expectations for all students

We’re impatient! We don’t want to be having this same conversation 10 years from now.
REFORM — AGAIN AND AGAIN AND . . .

- The U.S. has a long history of trying to “fix” education

- And an almost equally long history of failing to do so

ambitious new curriculum materials (1960s, 1990s, 2010s)

professional development (1980s)

rigorous academic standards (1960s, 1980s, 2000s, 2010s)

teacher preparation reform (1960s, 1980s, 2010s)
A LEGACY OF GOOD IDEAS

- Rigorous academic standards
- High-quality aligned curriculum materials
- Assessment and data-driven practice
- Professional learning community
- Mentoring, coaching, feedback
- Strong leadership

But these have frequently disappointed . . . because they have too often not led to deep improvement in students’ achievement. Why not?
EYES ON THE REAR-VIEW MIRROR

How can we learn from past efforts to improve our use of these levers, and the effects on young people’s opportunities and outcomes?

How do we anticipate and avoid unintended negative effects?

How do we connect the dots to students’ learning?
WHAT DOES IT TAKE TO IMPROVE STUDENTS’ LEARNING?

Recruit “talent” to teaching?

High-quality curriculum materials?

Better professional training?

Working with colleagues?

Assessment and use of data?
WHAT DOES IT TAKE TO IMPROVE STUDENTS’ LEARNING?

What does it take to impact students’ learning?

Recruit “talent” to teaching?

High-quality curriculum materials?

Working with colleagues?

Assessment and use of data?
WHAT DOES IT TAKE TO IMPROVE STUDENTS’ LEARNING?

Clue: Must get inside of and affect *instruction*—what students and teachers do with the content in classroom environments.

Recruit

High-quality curriculum materials?

Assessment and use of data?

Working with colleagues?
WHAT IS INSTRUCTION?

Instruction is co-constructed

- ... in broad socio-political, historical, economic, cultural, community, family environments
- ... through the interpretations and interactions of teachers, students, and “content”

Cohen, Raudenbush, and Ball (2003)
WHAT IS THE WORK OF TEACHING?

Taking responsibility for deliberately maximizing the quality of these interactions . . .

- . . . in ways that maximize the probability that students learn
- . . . worthwhile content and skills
WHY “WORK” OF TEACHING”?

1. To focus our attention on what teachers DO and to distinguish this from other features of classrooms, such as instructional formats, classroom culture and norms, what students are doing, how the curriculum is designed
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But what about small group work, or problem solving with open-ended problems, or seatwork? Aren’t those what teachers DO?
WHY “WORK” OF TEACHING”?

1. To focus our attention on what teachers DO and to distinguish this from other features of classrooms, such as instructional formats, classroom culture and norms, what students are doing, how the curriculum is designed

2. To honor the effortful and deliberate nature of teaching and not to leave it invisible, implicit, and taken for granted
You ask your fourth graders to explain what a rectangle is. One child offers a definition:

A rectangle is a flat shape. It has four square corners, and it is closed all the way around.
WHAT IS THE WORK FOR THE TEACHER?

1. See that something is missing
2. Decide what to do or say
3. Offer a counterexample

A rectangle is a flat shape. It has four square corners, and it is closed all the way around.

What is a shape that satisfies this definition and yet is not a rectangle?
WHAT IS THE WORK FOR THE TEACHER?

1. See that something is missing
2. Decide what to do or say
3. Offer a counterexample

“Is this a rectangle?”

A rectangle is a flat shape. It has four square corners, and it is closed all the way around.

(straight sides)
(exactly four square corners)
A rectangle is a flat shape with **straight sides that are connected at exactly** four square corners. It is closed all the way around.
THE MINICOMPUTER

- Abstract mathematical context for work on number relationships, mathematical structure, arithmetic properties (e.g., distributive property), even and odd numbers
- Also a setting for developing skills of mathematical argument and analysis, as well as proof
- Novel and complex mathematical environment for children
INSTRUCTION

Virshawn between 11:19 – 11:27

Paper airplane

What is the work of teaching?
AT 11:28, VIRSHAWN TAKES THE ROLE OF THE TEACHER
VIRSHAWN, ONE WEEK LATER

THE TWO-CHECKER PROBLEM

What numbers are possible to make on the Minicomputer with exactly two positive checkers?
ADDING A NEGATIVE CHECKER

The children found that 7, 11, 13, 14, and 15 were impossible with exactly two checkers.

EXTENSION:
Can you make 7, 11, 13, 14, and 15 if you have a negative checker? You must use both positive checkers and you can use one negative checker if it is useful.

I think the negative checker is awesome.
VIDEO: WHAT IS THE WORK OF TEACHING?

Then the purple is a four, the red is a two, and the white is a one, so you couldn't do it without a- without if- without another negative number.
WHAT IS THE WORK OF TEACHING IN THIS EXAMPLE AND WHAT ARE THE SPECIFIC PRACTICES?

- Trusting Virshawn to be mathematically engaged
- Making explicit positive mathematical roles that actively include and support children (e.g., “being the teacher”)
- Creating opportunities to “practice mathematics”
- Explicitly scaffolding an opportunity to develop agency through “proving the impossible”
- Using mathematics as a context for positive roles and identity
THE URGENCY, AND OUR SPECIAL ROLE
THE URGENCY, AND OUR SPECIAL ROLE

Skillful teaching is powerful. Unskillful teaching is dangerous.

Many, many children are being taught by underprepared beginning teachers.

Skillful teaching can be taught and learned.
SKILLFUL TEACHING IS NOT NATURAL

- What does the actual work involve?
- How can it be unpacked and explicitly taught to novices?

Knowing and thinking about content in special ways for teaching (CKT)

High-leverage practices (HLPs) of teaching

Core foundations of ethical and responsible teaching
HIGH-LEVERAGE PRACTICES

- Things teachers DO—
  - All the time!
  - That leverage students’ learning and flourishing
  - That put young people at risk when done badly
  - That create equitable access to ambitious content
  - That can be named at a grain-size that is useful for learning to do the work
  - That can be represented, decomposed, and approximated
  - That can be taught to beginners, and support the development of more advanced practice later
  - That can be assessed
SOME OF THE HIGH-LEVERAGE PRACTICES

- Explaining and modeling content, practices, and strategies
- Leading a group discussion
- Eliciting and interpreting students’ thinking
- Establishing norms and routines for classroom discourse and work
- Diagnosing particular common patterns of student thinking and development
- Learning about students’ cultural, religious, family, intellectual, and personal experiences and resources for use in instruction
- Setting up and managing small group work
- Building respectful relationships with students
- Checking student understanding during and at the conclusion of lessons
- Providing oral and written feedback to students on their work
- Setting long- and short-term learning goals for students
- Talking about a student with parents or caregivers

1TeachingWorks and the University of Michigan School of Education
WHAT IS FOUNDATIONAL TO SKILLFUL TEACHING?

1. The goal of classroom teaching is to help every student learn worthwhile knowledge and skills and develop the ability to use what they learn for their own purposes.
2. All students deserve the opportunity to learn at high levels.
3. Learning is an active sense-making process.
4. Teaching and learning are interactive with and constructed together with students.
5. The contexts of teaching matter, and teachers must understand, manage, and use them well.
CONTENT KNOWLEDGE FOR TEACHING (CKT)

Subject Matter Knowledge
- Common Content Knowledge (CCK)
- Horizon Content Knowledge (HCK)
- Specialized Content Knowledge (SCK)

Pedagogical Content Knowledge
- Knowledge of Content and Students (KCS)
- Knowledge of Content and Teaching (KCT)
- Knowledge of Content and Curriculum (KCC)
COMMON CONTENT KNOWLEDGE (CCK)

- What is a key theme in Zola Neale Hurston’s *Their Eyes Were Watching God*?
- Put these fractions in order: $\frac{3}{7}, \frac{5}{6}, \frac{11}{12}, \frac{6}{14}$
- Where do green plants get nutrition?
- What is “voting”? 
SPECIALIZED CONTENT KNOWLEDGE (SCK)

- What is a “theme” of a text? How is it different from the “main idea”?
- Explain what it means that the rational numbers are “infinitely dense” on a number line in a way that explains what that concept means.
- Explain what it means for there to be a 50% chance of rain.
- Choose two contrasting examples of reaching a decision through voting that highlight what voting is for.
DEVELOPING INSTRUCTIONAL PRACTICE

- Work on specific instructional practices, wrapped around content
- Practice instructional moves
- Develop CKT fluency
- Develop ability to consciously attune to learners
- Using curriculum materials for instruction and for developing practice

Cohen, Raudenbush, and Ball (2003)
AN INHERENT FACT OF TEACHING

Is that we are always communicating, relating, and making sense across difference, including:

- Age
- Gender
- Race, ethnicity, culture, religion
- Identities
- Language
- Experience

So this means that fundamental to the work of teaching is attuning to other people, and being oriented to others’ ideas and ways of thinking and being.
What number does the orange arrow point to?
Explain how you figured it out.
VIDEO: ANIYAH AND TONI

This video and additional supporting materials are available online [here](#).
READING STUDENTS’ WORK

2/4

Explain how you know: because there are equal parts and you are pointing to the second one so it's 2/4.

Give a complete sentence with one goal for yourself for our math class. Give an example of what it looks like to do this really well.

to listen to other people’s ideas. Like just because I know the answer that I will still listen to others.
What number does the orange arrow point to?

Explain how you know: There's 0.2 spaces
1.2 spaces then 2.2 spaces
in those 2 spaces are fractions
What number does the orange arrow point to? \[ \frac{1}{4} \]

Explain how you know: because it's divided in \[ \frac{1}{4} \] units and it's \[ \frac{1}{4} \] of all the parts.
What number does the orange arrow point to? \[ \frac{1}{3} \]

Explain how you know: There is \( \text{two} \) lines, instead of \( \frac{3}{3} \) plus the 1 square.
A SECOND EXAMPLE: ASSIGNING MATHEMATICAL COMPETENCE

1. Broaden and name what being competent in mathematics means

2. Intervene to position who (and what) is seen as competent in math class

3. Support individual children to develop their mathematical and academic identities and competence

Sources: E. Cohen and R. Lotan, complex instruction; J. Boaler’s work; Smarter Together: Collaboration and Equity in the Elementary Mathematics Classroom (Featherstone, Crespo, et al., 2011);
WHAT DO MANY “HEAR” IN ANIYAH AND TONI?

ANIYAH
- She has the wrong answer: 1/7

TONI
- She is playing with her hair and trying to get attention
- She is trying to embarrass Aniyah
WHAT DO ANIYAH AND TONI KNOW AND WHAT CAN EACH DO?

ANIYAH

- Uses the definition for a fraction to explain
  - She identifies the “whole”
  - She makes sure the intervals are equal
  - She counts intervals and not tick marks
  - She knows how to write “one-seventh”
- Produces a mathematically well-structured explanation
- Presents her ideas clearly

TONI

- Listens closely to a classmate’s presentation
- Uses the definition for a fraction to ask
  - How Aniyah decided on 7 parts
- Asks a pointed mathematical question
A THIRD EXAMPLE: TRANSLATING INTO LEARNER LANGUAGE

3.NFA.1: Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into $b$ equal parts; understand a fraction $a/b$ as the quantity formed by $a$ parts of size $1/b$.

3.NFA.1 and 2: Understand a fraction as a number on the number line; represent fractions on a number line diagram.

MP.1. Make sense of problems and persevere in solving them.

MP.3. Make and critique mathematical arguments.

But how can I translate this in ways that make sense for my learners?
TRANSLATING: DEFINING A FRACTION

Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into $b$ equal parts.

- Figure out what the whole is.
- Figure out if the whole is divided into equal parts.
- If not, make equal parts.
- Count how many equal parts there are.
- Write $1/d$ to show one of the equal parts. This is a unit fraction.

Understand a fraction $a/b$ as the quantity formed by a parts of size $1/b$.

- If more than one of those parts is shaded, count them (n) and write $n/d$. 

Steps for Naming a Fraction Correctly
1. Figure out what the whole is.
2. Figure out if the whole is divided into equal parts. If not, make equal parts.
3. Count how many equal parts there are.
4. Write $\frac{1}{d}$ to show one of the equal parts. This is a unit fraction.
5. If more than one of those parts is shaded, count them (n) and write $\frac{n}{d}$. 

6. $d \neq 0$. 7. $d$ is a whole number now.
TRANSLATING: DEFINING A FRACTION

Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into $b$ equal parts.

- Figure out what the whole is.
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- Write $1/d$ to show one of the equal parts. This is a unit fraction.

Understand a fraction $a/b$ as the quantity formed by $a$ parts of size $1/b$.

- If more than one of those parts is shaded, count them ($n$) and write $n/d$.

I need to “talk” the idea of $1/d$ in ways that make sense for my learners.
THE LESSONS NOT LEARNED FOR LEVERAGING THESE GOOD IDEAS

- Rigorous academic standards
- High-quality aligned curriculum materials
- Assessment and data-driven practice
- Professional learning community
- Mentoring, coaching, feedback
- Strong leadership
EYES ON THE REAR-VIEW MIRROR
FEET ON THE ACCELERATOR

How can we learn from past efforts to improve our use of these levers, and the effects on young people’s opportunities and outcomes?

Keep asking: are we getting inside of instructional practice?

Are we attending to negative unintended consequences?
THANK YOU!

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Slides will be available on my website
deborahloewenbergerball.com
(Google Deborah Ball)
Graphic on slides 9, 10, and 34:

Graphic on slides 18, 21, and 22:

Graphic on slide 31: