Rowing with both oars: Engaging all students to raise mathematics achievement

Photo credit: Tim Lucas (via Flickr)

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Our agenda

- Four underlying ideas to engage students

- Math talks and promoting student discourse
- Formative assessment and re-engagement
  - The what, why, and how
  - Classroom experiences and effects
  - Professional learning activities, resources, tools

Introductions: Like Me

Please stand if you feel a statement is "like you":

- You have ever taught high school mathematics
- You have ever taught middle grades mathematics
- You have ever taught elementary mathematics
- You have ever taught a subject other than mathematics
- You have seen or worked with or used MARS tasks
- You've seen practices for promoting student discourse
- You have ever coached math teachers
- You have ever facilitated teacher professional development
- As a teacher, you ever worked with students who struggled
- As a teacher, you ever wanted students to be more confident
- As a teacher, you ever wanted students to be more engaged

A climate that supports learning

- Students want to learn, but need to feel safe to engage (and so they do more of the work)

- Structures to engage more students
- Wait time is think time – so is talk time
- Expecting students to listen – to each other
- Viewing mistakes as gifts

Get kids to buy into participating

- Participation is key to learning – students must buy in to make it happen

- Sharing work – accountability and audience
- Ways to show that we value student thinking
- Providing time for students to make sense
- Students do the work, teacher orchestrates

Frustration is a part of learning

- Algebraic thinking can be frustrating for students, especially those who have struggled

- Ideas of productive struggle, effective effort, and growth mindset can help engage students
- Accessible but demanding problems can help
- Classroom structures to support students' thinking and confidence can engage them too

Effective PD supports transfer

- Focused structures can support teachers' use of small but significant techniques to bring these big ideas into their classrooms

- Safe environment: community agreements
- A virtuous cycle of learning, trying, and effects
- Parallels for adult and adolescent learners

Community Agreements

- No one is as smart as all of us are together
- Leave no one behind
- Respect
- Individual think time
- Everyone participates
- Everybody helps

One key question

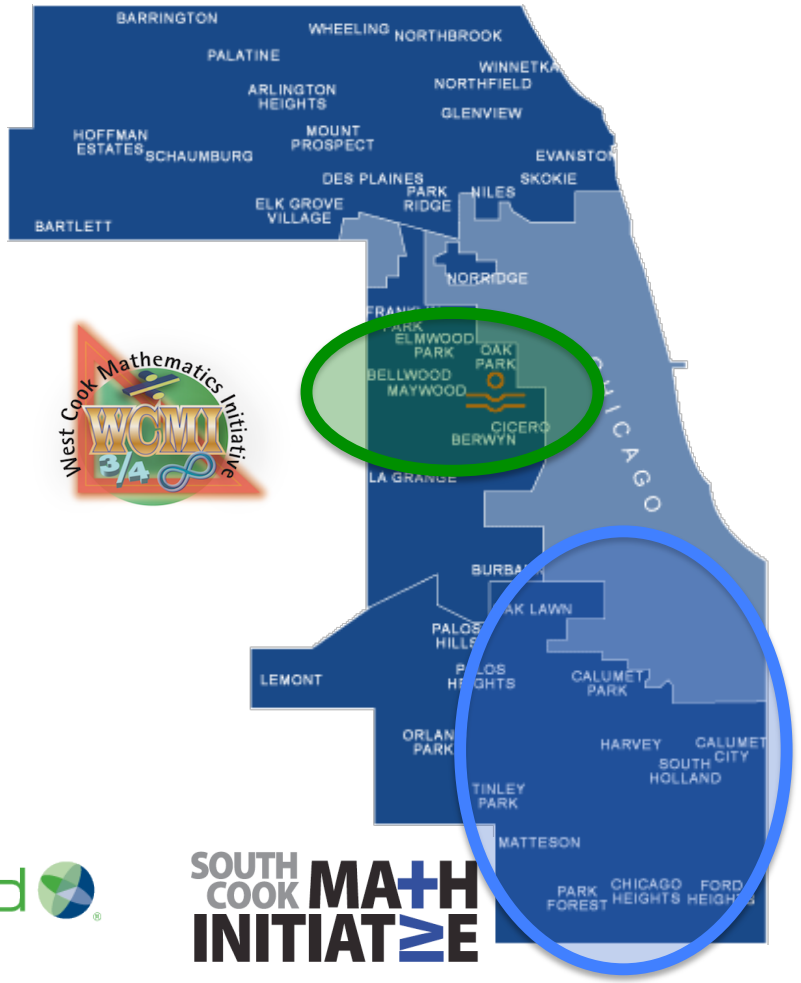
- What motivated and enabled teachers to change their practice?

- Valuing student thinking
- Ideas of formative assessment
- Doing mathematics together
- Doing (and reflecting), not (just) reading
- Collaboration and coaching

Some brief context

Suburbs with evolving demographics

Two partnerships of 32 school districts, a community foundation, state service centers, university coaches and faculty, and nationally-known experts



WEST40 Intermediate Service Center No. 2

SCISC4 SOUTH COOK INTERMEDIATE SERVICE CENTER

THE CHICAGO COMMUNITY TRUST

Learning Sciences Research Institute
The University of Illinois at Chicago

EDC Learning transforms lives.

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SOUTH COOK MATH INITIATIVE

Acknowledgements

Support for the South and West Cook Mathematics Initiatives is provided by the Searle Funds at The Chicago Community Trust, in partnership with the South Cook Intermediate Service Center, the West40 Intermediate Service Center and the UIC Learning Sciences Research Institute.

Some important features

- Intentionally cross-district, across grades 6–9
- Across roles: coordination, coherence are key
- Going into the third year of 3–5 year initiatives – sustained work with relatively rapid scale-up
- Scale allows both joint problem-solving and for districts to draw on external expertise
- CCSSM have been a major driver of the work

Engaging students with a prompt

$$19 \cdot 31$$

- How might a classroom full of students engage with this prompt in a “traditional” model?

Let's try a math talk

- Facilitator presents prompt
- Participants generate multiple methods
- Signal number of methods with fingers
- Participants share methods
- Facilitator scribes
- Discussion

Demonstrating a Math Talk

$$19 \cdot 31$$

- Think of as many ways as you can to find the answer. Signal your ways using your fingers.

Pair reflection

With your other shoulder partner, consider:

- What are the effects on student engagement?
- How would each method enable connections?
- Would there be changes in student discourse?
- How do the two methods differ?

Math talks

A **daily ritual** with the **entire class** to develop conceptual understanding of **and** efficiency with numbers, operations and mathematics — in approximately 10 minutes per day.

Math Talks are used to:

- Introduce concepts and properties about numbers
- Review, practice, reinforce procedures and concepts
- Explore mathematical connections and relationships

What makes math talks different?

How does a math talk differ from a traditional opener, bell-ringer, or "Do Now" problem?

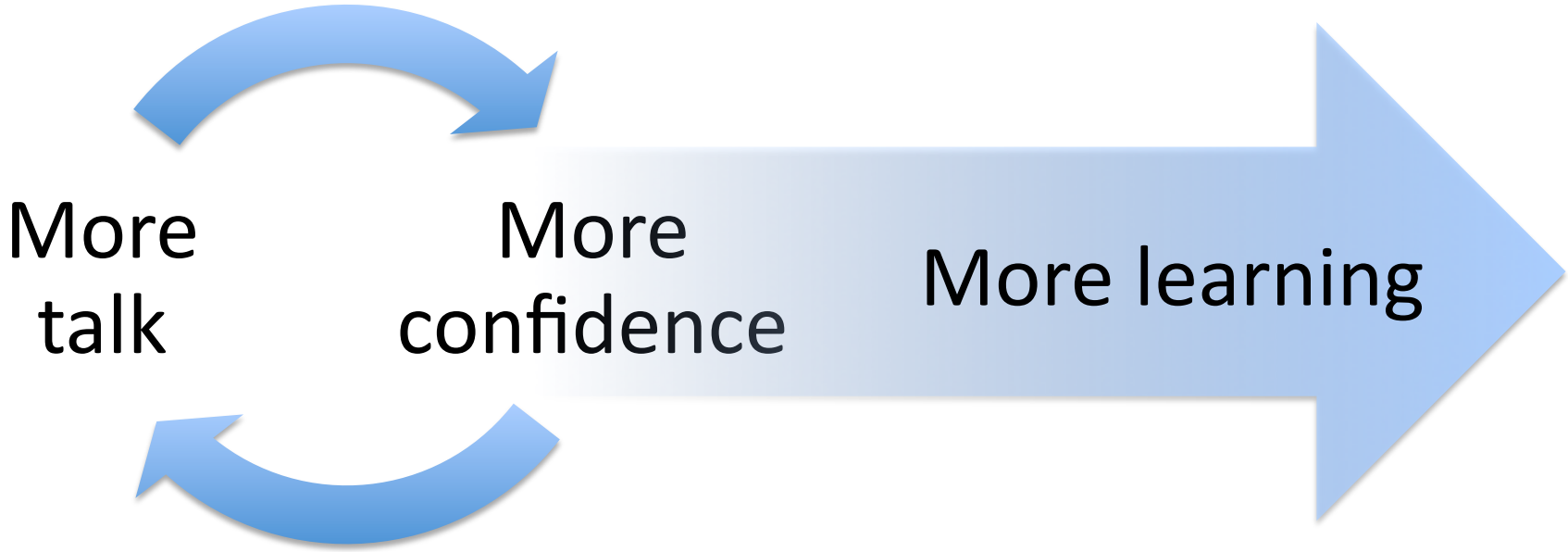
- Open-ended prompt
- Facilitation cues
- Scribing responses (with student names)
- Questioning, justifying, and critiquing
- Opportunity to connect methods

Math talks can…

Show students that we value their thinking:

- Engage more students in more thinking
- Model mathematical discussions and critique
- Give us information for formative assessment
- Show there is more than one way of thinking
- Focus on learning math, not answer-getting

The power of student discourse

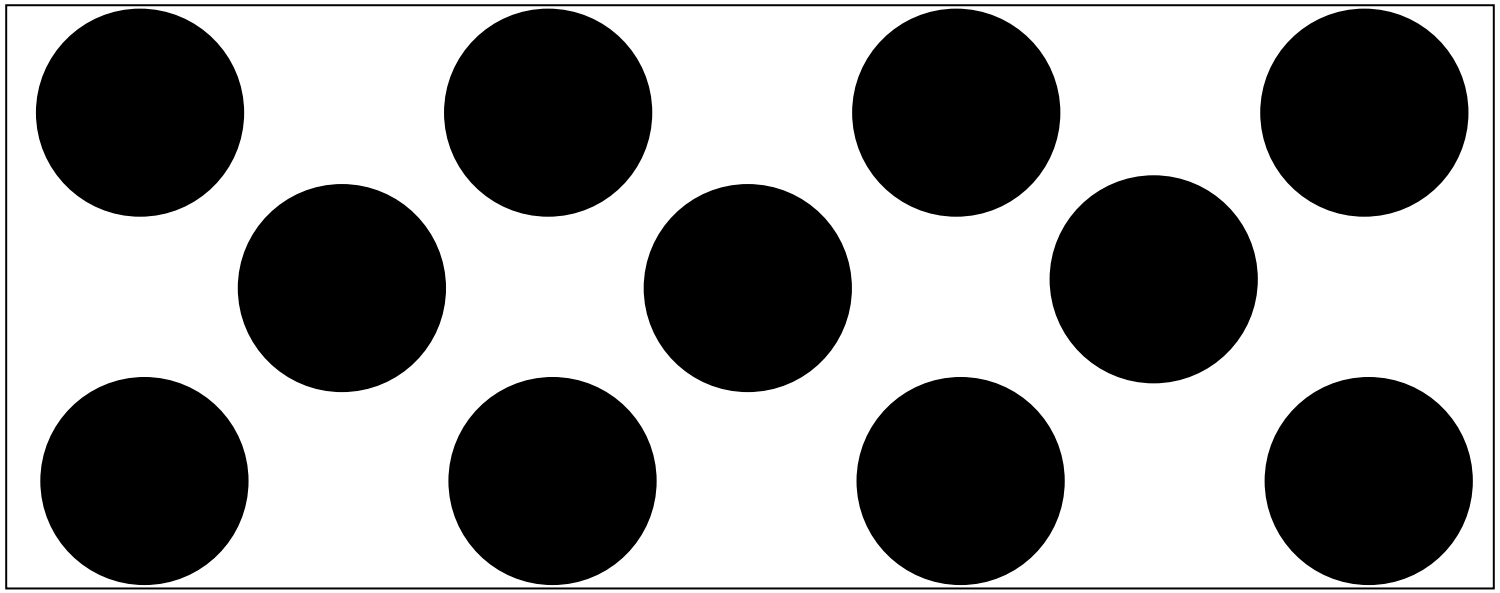


Professional learning experiences

- Modeling math talks
- Trying math talks often
- Keep reflecting
- Explicitly consider features and hindrances
- Encourage sharing and collaboration: wikis
- Gradually expand topics, structures, and uses to build from basic comfort to intentionality

Introducing math talks

How many dots?



How did you see them?

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How do we get Math Talks to work?

Math talks may have potential, but how do we get them to work in real classrooms?

- With a partner, discuss features, routines, or teacher moves that can help make math talks **work well** to promote student learning.
- Note any **possible challenges**, concerns, or questions you have about making math talks work in the classroom.

Professional learning experiences

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Potentially effective features

- Individual think time
- Finger signals make it safe
- Elicits multiple methods, not just right answer
- Students must talk to explain/justify method
- Students must make sense of others' methods
- Scribing helps students follow what's going on
- Visual representations can get kids talking
- Opportunities to connect and generalize

Potential challenges and concerns

- What if no one says anything?
- How do you handle wrong answers?
- What if students' explanations are unclear?
- What if students don't make connections?
- What is appropriate for teacher to say/add?
- How and when do you end the math talk?
- Can the math talk routine be modified? How?
- What if math talks are getting boring for kids?

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Planning Math Talks *Intentionally*

Math talks can help develop students' proficiency in making arguments and critiquing reasoning.

Just like re-engagement lessons, math talks are most effective when you:

- Have a **goal** for your use of the math talk
- Have **anticipated** potential student responses

With a partner, think about a possible **goal** for a math talk, come up with a **prompt**, and think of possible student responses (correct or incorrect).

Many varieties of math talks

- Number of the Day
- Number Lines
- Mental Math
- Sequences of Related Expressions
- Relational Thinking
- What's My Rule?
- Spatial Visualization

Math talks can also…

Develop and reinforce a wide range of skills:

- Sense for numbers, relationships, operations
- Fluency: Efficiency, accuracy, and flexibility
- Communication and explanation
- Logical thinking, reasoning, and arguments
- Problem-solving

(Many connections with the CCSSM SMP!)

Some other strategies

- Pairs
- Wait time and questioning
- Making students listen to other students
- Pressing students to justify
- Gallery walks (questions before, during, after)
- Kagan structures

A note on getting the ball rolling

We've described a "virtuous cycle" for students and for teachers. But how do we get the ball rolling in the first place? Some helpful nudges:

- Dissatisfaction with existing student learning
- Administrative buy-in and incorporation (or promise thereof) into supervisory practice
- Coaching (affirmation, encouragement, and support; pressing to reflect; and just noticing)

Let's do some math

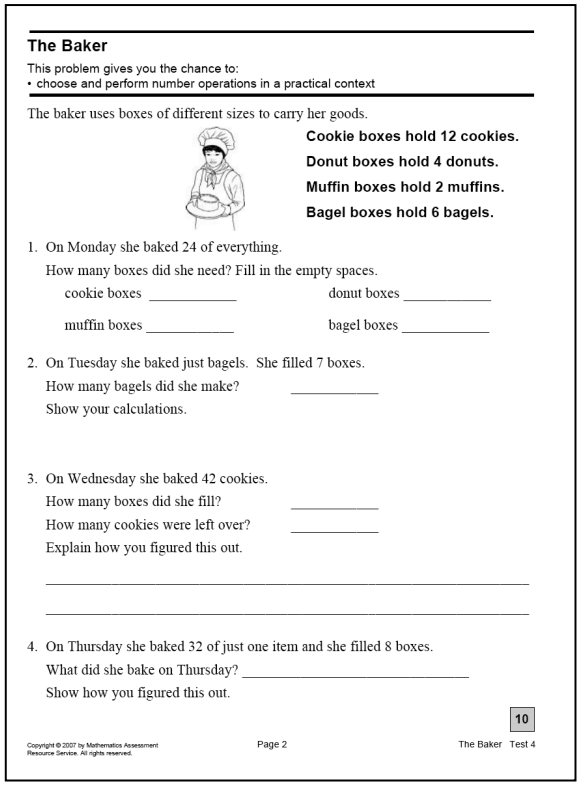
Work the **Area and Perimeter** MARS task.

As you work, consider:

- What is the key mathematics in this task?
- What (other) methods might students use?
- What errors might students make?
- How might students' work guide us about their understandings and misconceptions?

Performance Assessments

To Inform Instruction And Measure Higher Level Thinking



The Baker

This problem gives you the chance to:
• choose and perform number operations in a practical context

The baker uses boxes of different sizes to carry her goods.

Cookie boxes hold 12 cookies.
Donut boxes hold 4 donuts.
Muffin boxes hold 2 muffins.
Bagel boxes hold 6 bagels.

1. On Monday she baked 24 of everything.
   How many boxes did she need? Fill in the empty spaces.
   cookie boxes _____ donut boxes _____
   muffin boxes _____ bagel boxes _____

2. On Tuesday she baked just bagels. She filled 7 boxes.
   How many bagels did she make? _____
   Show your calculations.

3. On Wednesday she baked 42 cookies.
   How many boxes did she fill? _____
   How many cookies were left over? _____
   Explain how you figured this out.

4. On Thursday she baked 32 of just one item and she filled 8 boxes.
   What did she bake on Thursday? _____
   Show how you figured this out.

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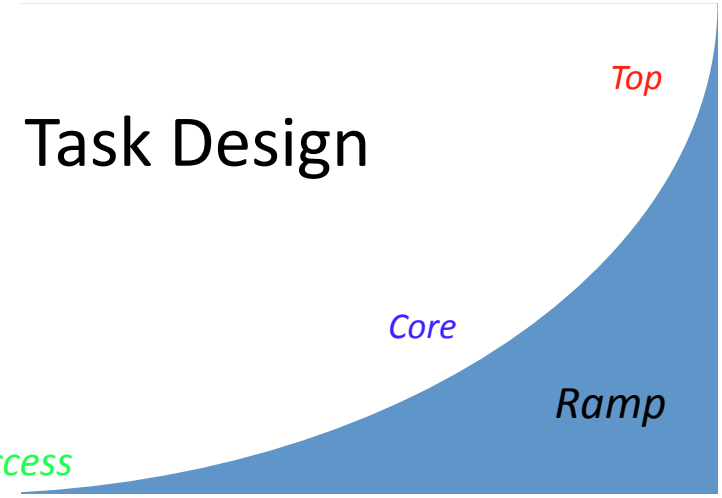


Entry level (access into task)

Core Mathematics - (meeting standards)

Top of Ramp (conceptually deeper, beyond)

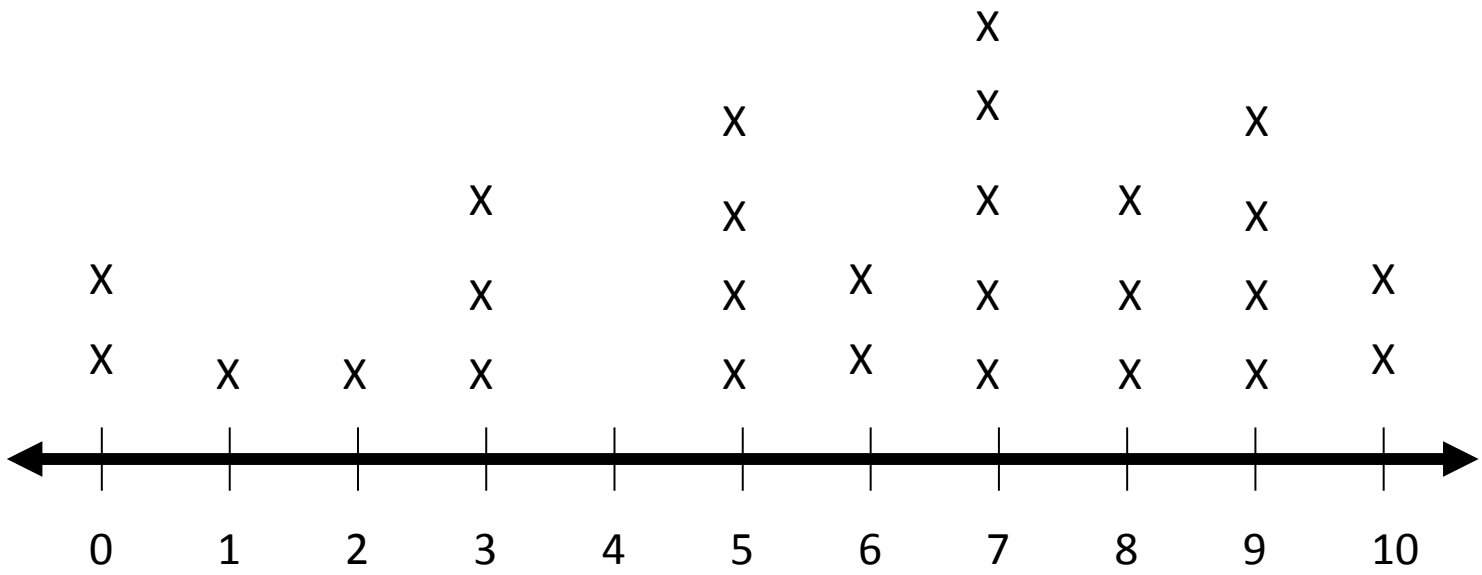
- The Mathematics Assessment Resource Service (MARS) is an NSF-funded collaboration between U.C. Berkeley and the Shell Centre in Nottingham, England.
- MARS Assessments target grades 2–Geometry and are aligned with the Common Core State Standards for Mathematics.

SHELL CENTRE

BALANCED ASSESSMENT

MARS

The Results from an Assessment



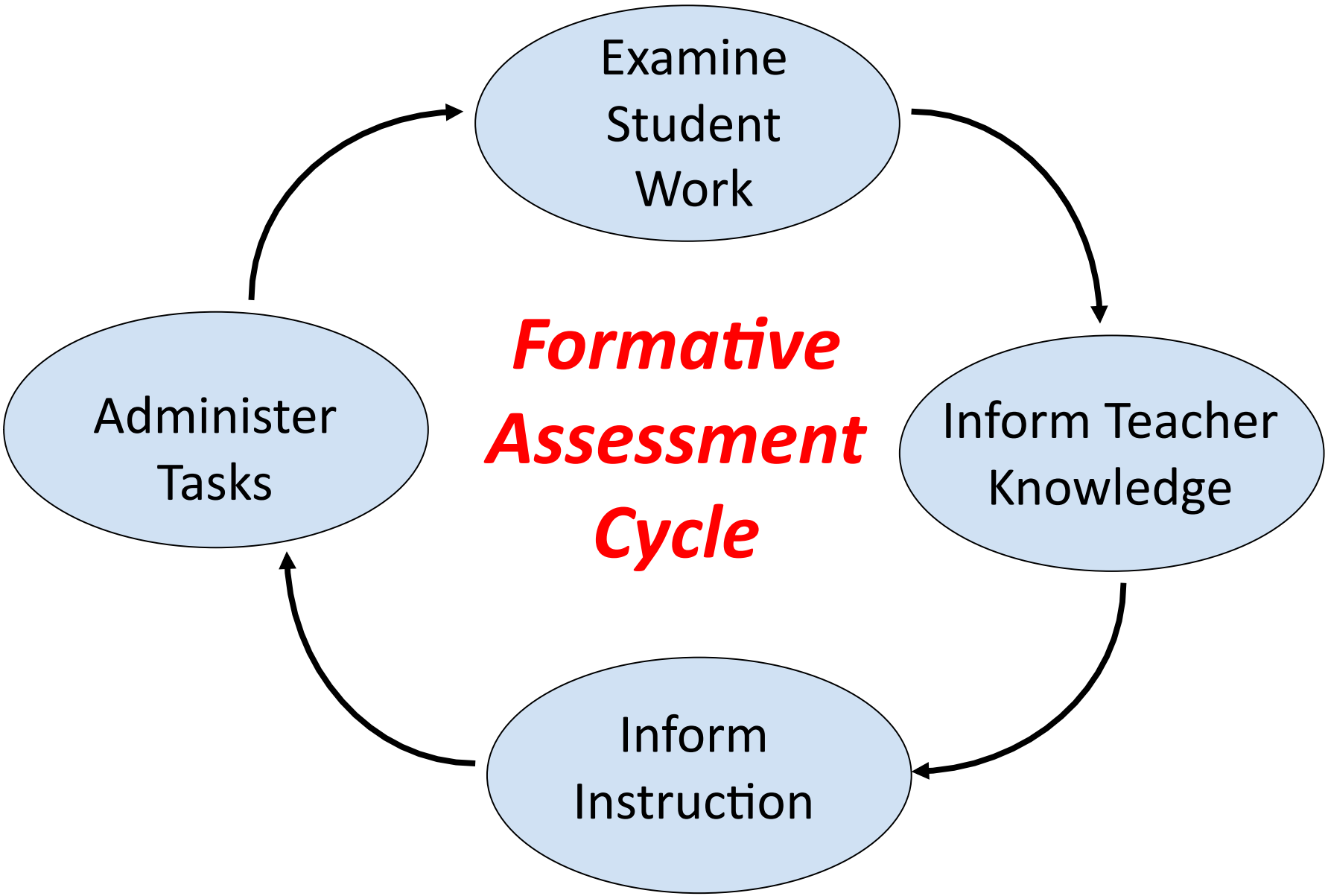
Students' performances are across the continuum.

Now what?

Now What?

Traditionally, teachers will do one of these:

- Stop. Re-teach the topic to the whole class.
- Identify students needing remediation and somehow find time to re-teach the topic to them, while the rest of the class moves on.
- Feeling the pressure of the over-packed curriculum, venture on to the next topic.


Examine Student Work
Inform Teacher Knowledge
Inform Instruction
Administer Tasks
Formative Assessment Cycle

Formative assessment is…

Students and teachers

Using evidence of learning

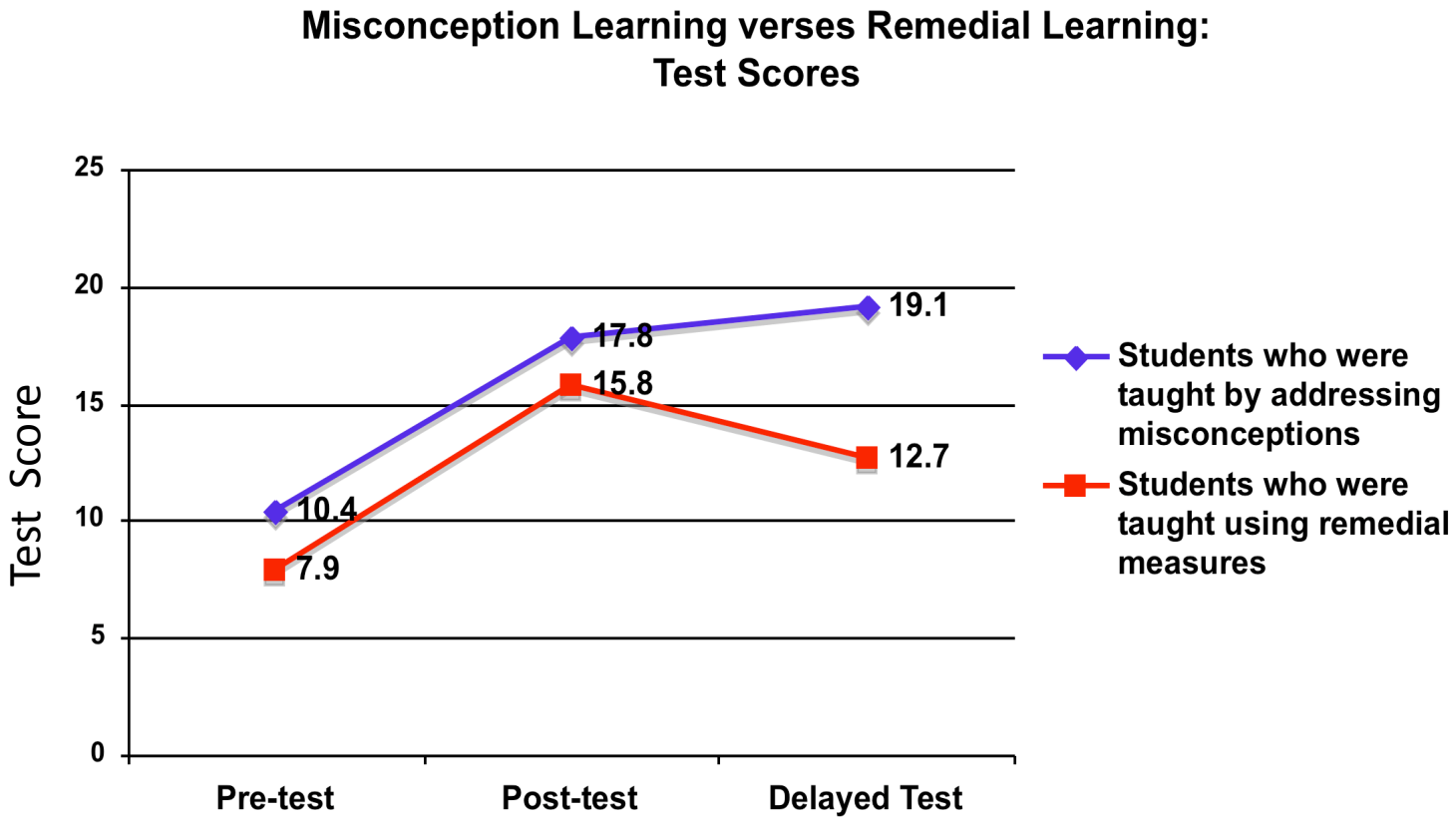
To adapt teaching and learning

To meet immediate learning needs

Minute-to-minute and day to day

— *Dylan Wiliam, University of London*

Why formative assessment matters: Instruction that repairs misconceptions compared to traditional remediation



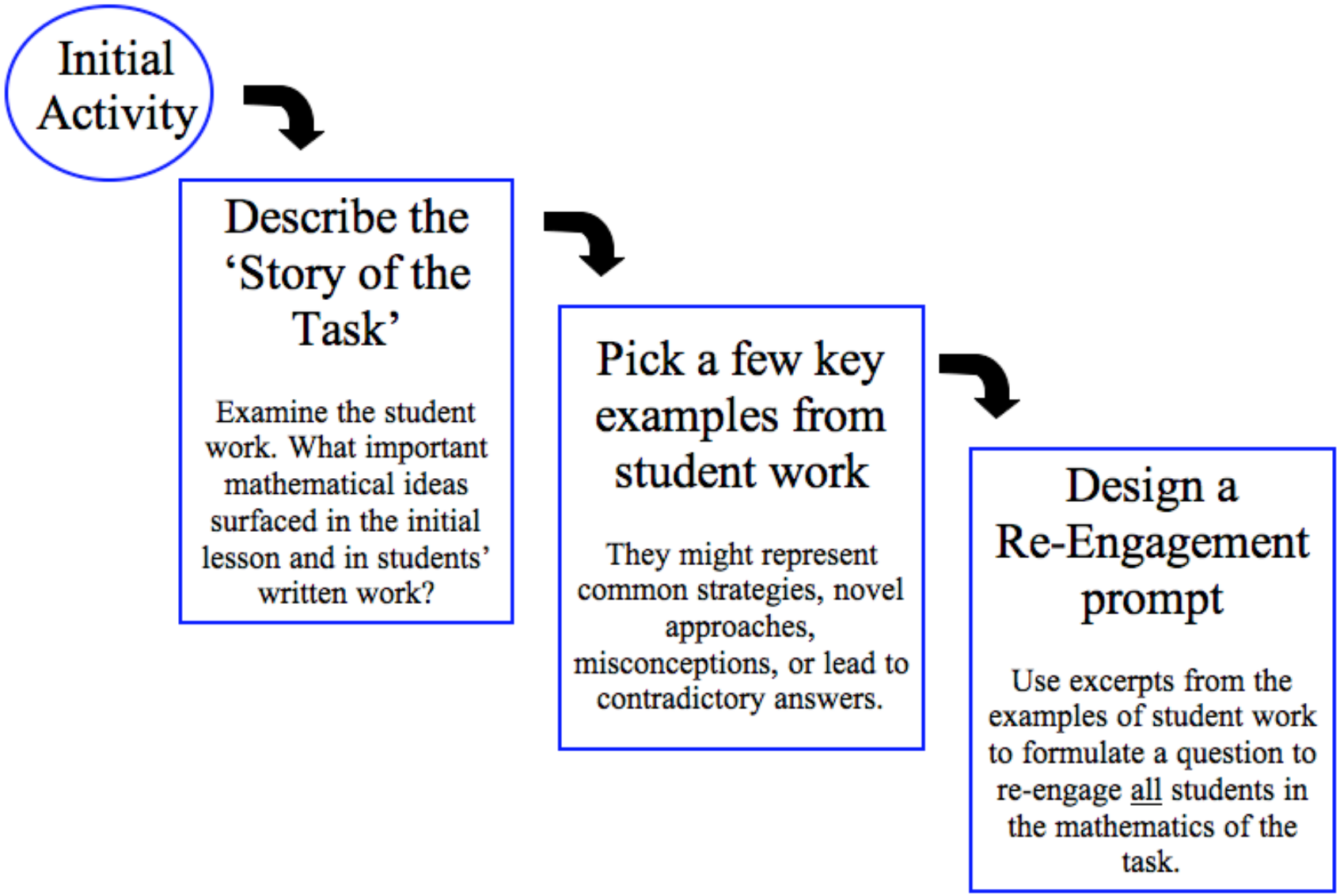
Bell and Swan

Formative Assessment Strategies

- Clarifying learning intentions, criteria for success
- Engineering effective classroom discussions
- Providing feedback that moves learners forward
- Activating students as owners of their learning
- Activating students as resources for one another

— *Dylan Wiliam, University of London*

Re-Engagement Protocol



A Re-Engagement Lesson

- Makes use of actual student work, including unique thinking, misconceptions, strategies.
- Has all students re-work a task from different perspectives.
- Confronts misconceptions, so that they can be repaired and released.
- Gives some students strategies to successfully solve the problem.
- Helps other students solidify, connect, and clarify their ideas.

Re-teaching vs. Re-engagement

- Teach the unit again.
- Address basic skills that are missing.
- Do the same or similar problems over.
- Practice more to make sure student learn the procedures.
- Focus mostly on underachievers.
- Cognitive level is usually lower.

- Revisit student thinking.
- Address conceptual understanding.
- Examine task from different perspectives.
- Critique student approaches/solutions to make connections.
- The entire class is engaged in the mathematics.
- Cognitive level is usually higher.

Possible Goals for Re-Engagement

- Clarify a mathematical idea or concept
- Compare strategies and explain why they work
- Generalize about classes of problems (move from specific answers to strategies)
- Confront misconceptions to understand an error in logic
- Provide specific feedback on student work
- Model characteristics of desired performance

Re-Engagement: Classroom Effects

- Deep thinking about math and misconceptions
- Structure for teacher reflection and collaboration
- Steadily more focused and effective lessons
  - Goals
  - Summaries
- Applying the structure and techniques to tests
- In activity lessons: “re-engage in the moment”
- Students actually changing what they look for

Professional learning experiences

- Good tasks, connected to the classroom
- Think about the math, the students, and steps
- Strong and specific protocols and tools
- Teacher engagement is active and concrete
- Try again and again — keep deepening
- Share in a community, reflect often & together

Summary

- Four underlying ideas to engage students

- Math talks and promoting student discourse
- Formative assessment and re-engagement
  - The what, why, and how
  - Classroom experiences and effects
  - Professional learning activities, resources, tools

Questions

What are your questions about…

- Big ideas about student engagement…
- Math talks and student discourse…
- Formative assessment and re-engagement…
- Our projects and professional learning…
- Or anything else?

Thank you!

Thank you for engaging in this session.

Please write your info on a list to receive electronic copies of our slides and materials.

And please contact us with questions or ideas:
sendhil@uic.edu