Improving mathematics teaching and learning in partnership with teachers: The critical role of systemic support

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Logistics for Today's Session

To access materials in Drive, type the following into your browser:

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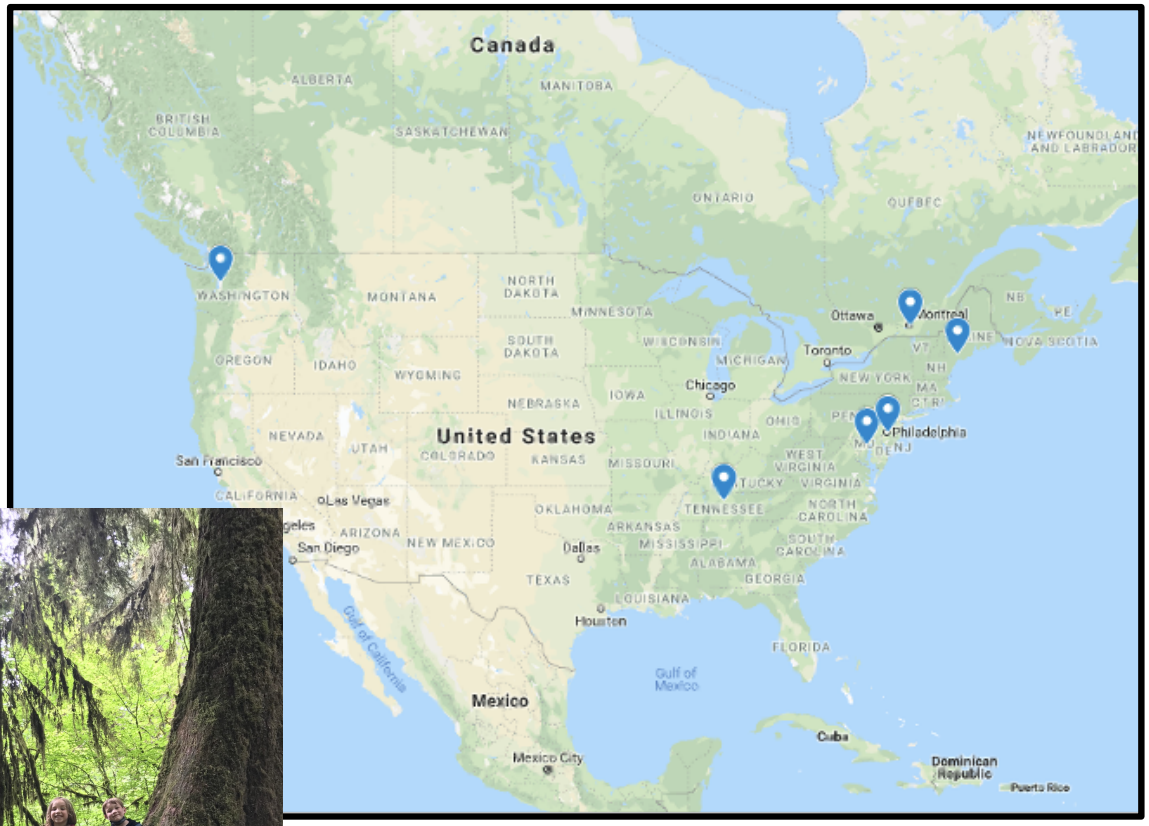
(There are also paper copies of select handouts.)

a bit about me …



working in **research-practice partnerships** with several school districts to improve mathematics teaching and learning at some scale

"research-practice partnerships …

- are long-term
- focus on problems/opportunities of practice
- are committed to mutualism
- produce original analyses"

(Coburn, Penuel, & Geil, 2013)

A “problem of practice”: improving mathematics teaching and learning at some scale

Mathematics education has made significant progress in detailing:

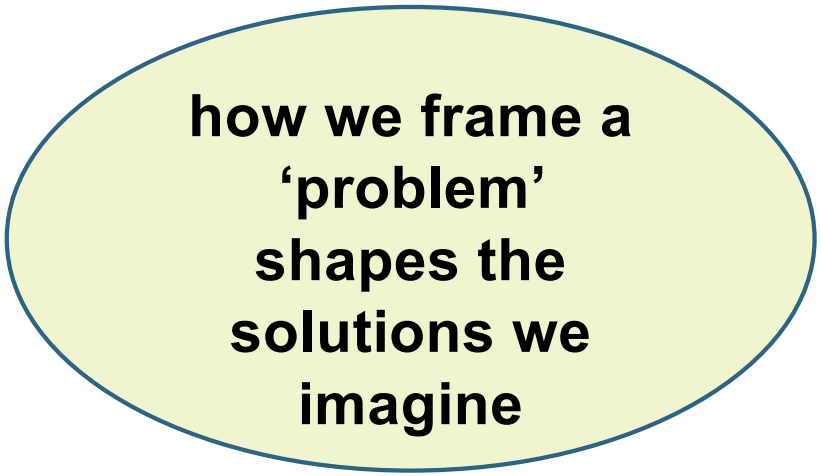
- a set of **rigorous learning goals for students**
  - making sense of mathematics, reasoning about mathematical ideas
  - view themselves and others as people who ‘do’ mathematics
- **vision of high-quality teaching** to enable students to attain these goals
  - select and implement cognitively demanding tasks in which students analyze problem-solving situations in order to figure out what procedures to use, and why
  - elicit and build on students’ contributions to achieve mathematical agendas
  - press and support students to elaborate their reasoning, connect their ideas

A “problem of practice”: improving mathematics teaching and learning at some scale

the enactment of this instructional vision is uneven

Clarifying the focal problem of improving math teaching & learning

What does it take to improve the quality of mathematics teaching at some scale, and especially in schools and classrooms serving students who have been disadvantaged?



Framing the problem of improving math teaching & learning

Improving mathematics teaching requires collective learning (*it is <u>not</u> an issue of mandating change)

Teachers need sustained, high-quality supports

Instructional materials

+

Opportunities to collaborate on the work of teaching (both analyzing and enacting new forms of teaching)

Framing the problem of improving math teaching & learning

Supporting the learning of teachers is necessary but not sufficient.

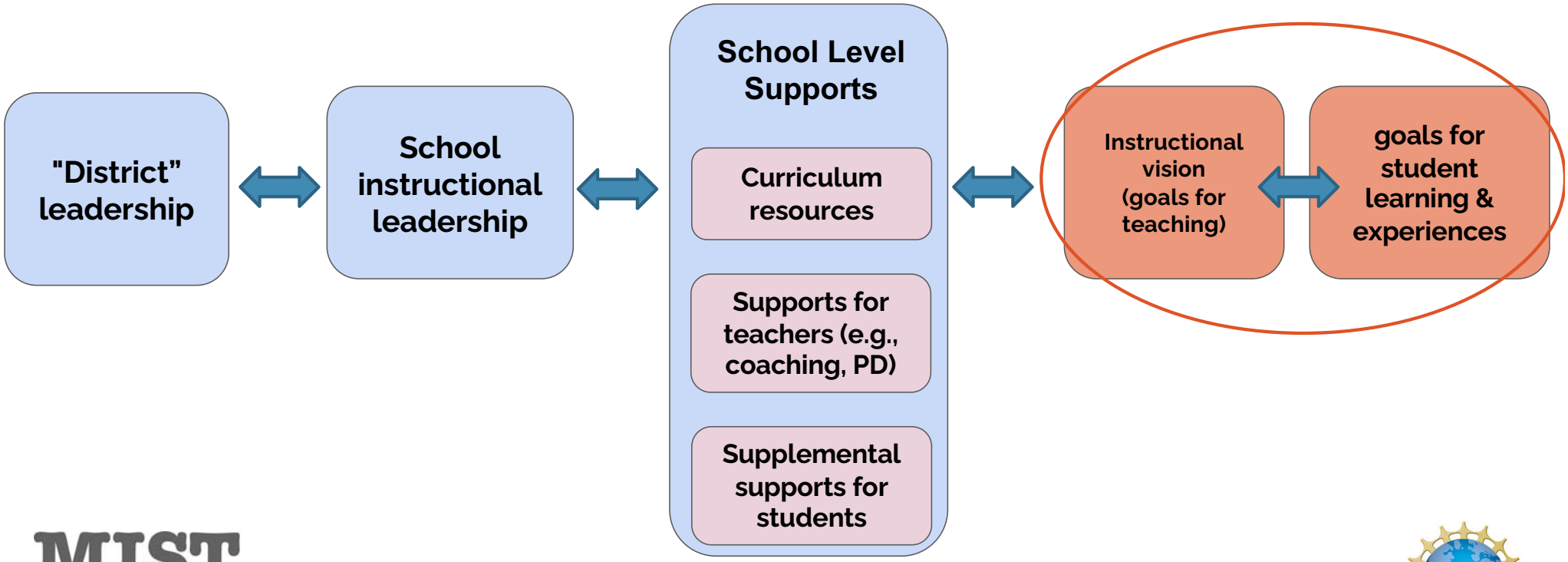
Why? Contexts (school, district) in which teachers work mediate the influence of professional development on classroom practice

→ This implies learning for all educators in the system, and for the organization more broadly, and researchers, too!

Improving mathematics teaching requires collective learning (*it is not an issue of mandating change)

Improving mathematics teaching requires coherent, systems of support

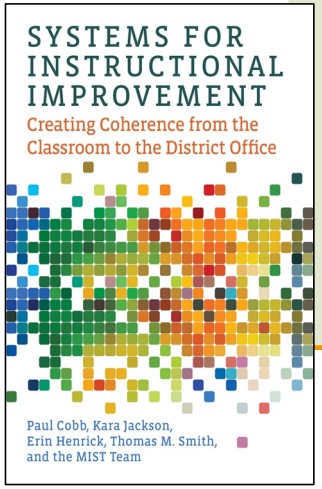
a systems perspective on improving teaching: **mapping backwards from the classroom to create coherent systems of support**



MIST
MIDDLE SCHOOL MATHEMATICS AND THE INSTITUTIONAL SETTING OF TEACHING

NSF

two key activities of improving teaching & learning from a systems perspective



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Identify potentially productive instructional improvement strategies

- **Theory of action** for instructional improvement at scale

MIST
MIDDLE SCHOOL MATHEMATICS AND THE INSTITUTIONAL SETTING OF TEACHING

2

implement improvement strategies reliably

systematically and rapidly **learn & revise strategies**

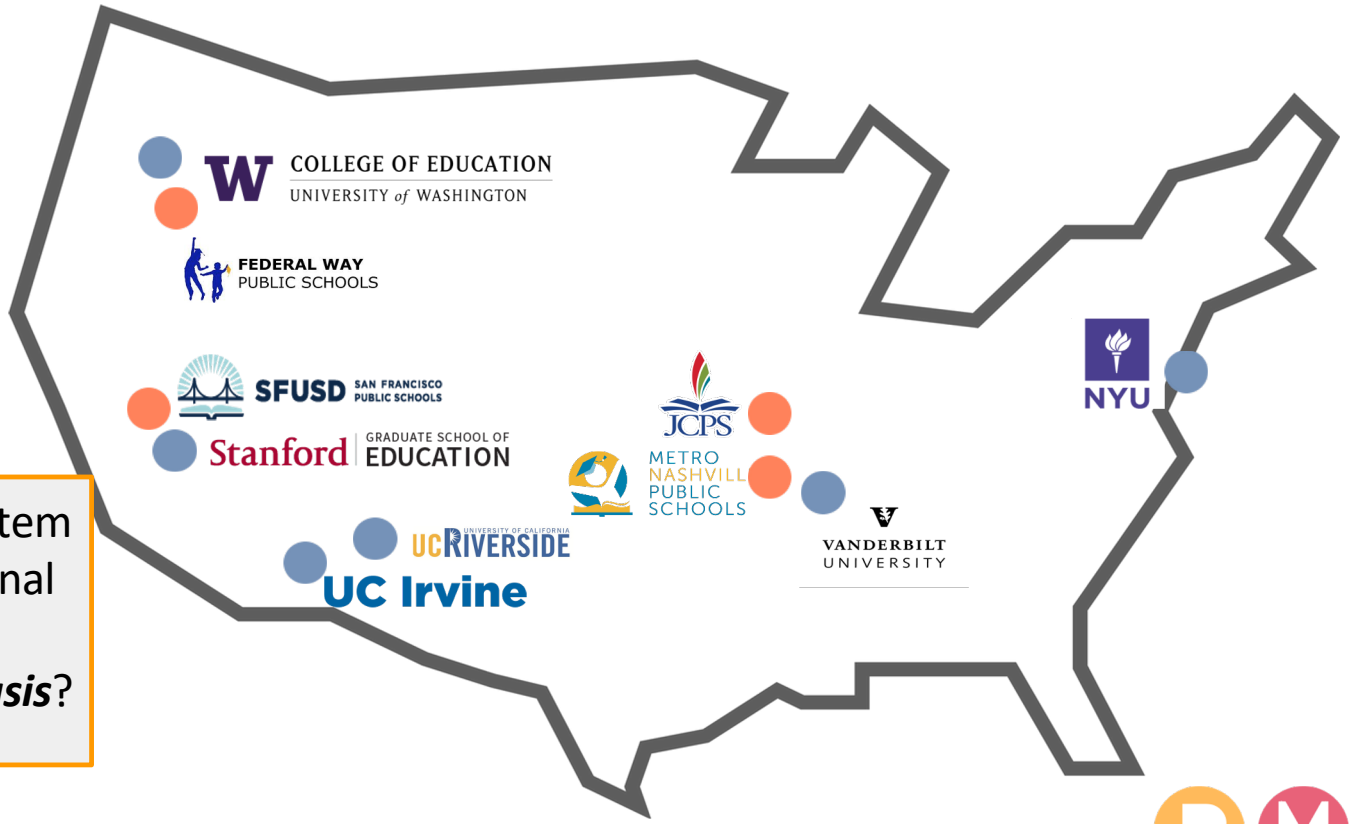
PM R2

the current project: 3 research-practice partnerships working to improve secondary mathematics teaching and learning

implement improvement strategies reliably

systematically and rapidly **learn & revise strategies**

How can we learn across a system what's happening in instructional improvement efforts ***easily***, ***rapidly***, and ***on an ongoing basis***?



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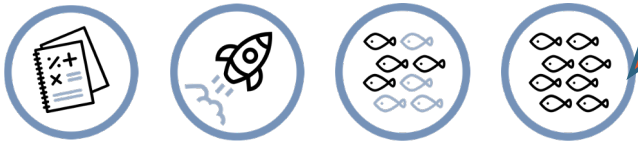
"practical measures" (Carnegie Foundation for the Advancement of Teaching)

- provide users with **timely** and **meaningful feedback** about targeted aspects of **practice** (i.e., things that make an important difference)
- easy to administer & resulting data is easy to analyze (i.e., '**practical**')
- enable users to **set goals**, **identify changes**, and **consider whether a change in practice is moving in the desired direction**
- used for the purposes of **improvement**, not accountability or evaluation

System of Practical Measures, Representations, & Routines

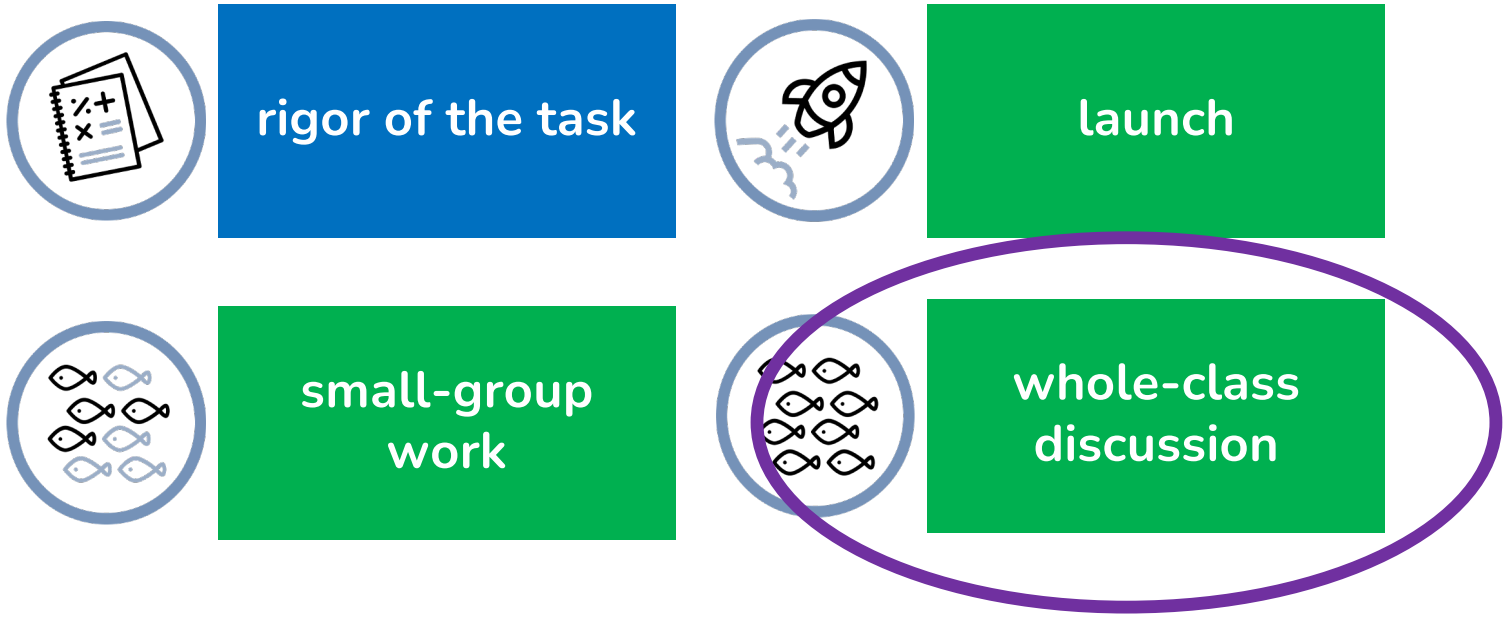
Practical measures of key aspects of **classroom instruction** that research has linked to student learning



Practical measures of key aspects of **professional learning** (e.g., one-on-one coaching, collaborative professional learning) that research has linked to teacher learning

Practical Measures of Key Aspects of Mathematics Instruction

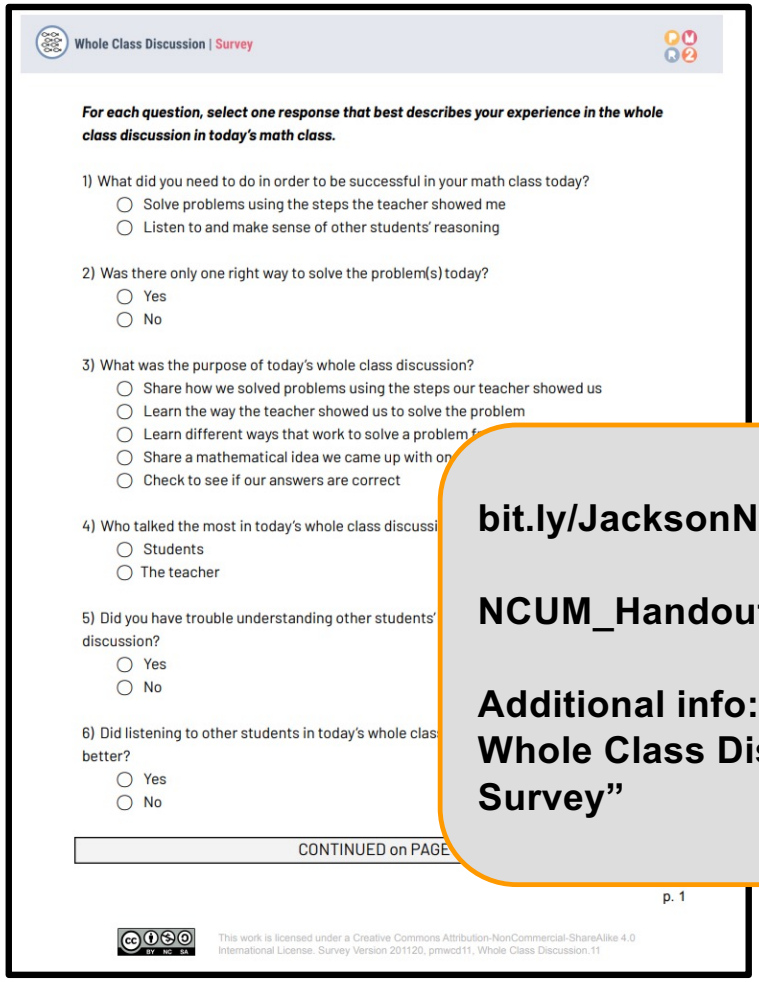
- Quick, easy to administer (e.g., surveys are 2-3 minutes, electronic or paper form)
- Developed in **partnership** with students, teachers, coaches, professional learning facilitators, and district math specialists



Example Practical Measure: Students' Perspectives of Whole-Class Discussion

Look at the Whole-Class Discussion Survey.

- Imagine the last whole-class math discussion you facilitated or observed. How do you think students would have responded to this survey?
- What can you learn from this?



Whole Class Discussion | Survey

For each question, select one response that best describes your experience in the whole class discussion in today's math class.

1) What did you need to do in order to be successful in your math class today?
- ◯ Solve problems using the steps the teacher showed me
- ◯ Listen to and make sense of other students' reasoning

2) Was there only one right way to solve the problem(s) today?
- ◯ Yes
- ◯ No

3) What was the purpose of today's whole class discussion?
- ◯ Share how we solved problems using the steps our teacher showed us
- ◯ Learn the way the teacher showed us to solve the problem
- ◯ Learn different ways that work to solve a problem
- ◯ Share a mathematical idea we came up with on
- ◯ Check to see if our answers are correct

4) Who talked the most in today's whole class discussi
- ◯ Students
- ◯ The teacher

5) Did you have trouble understanding other students'
discussion?
- ◯ Yes
- ◯ No

6) Did listening to other students in today's whole clas
better?
- ◯ Yes
- ◯ No

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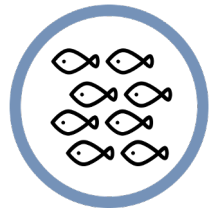

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Additional info: "Annotated Whole Class Discussion Survey"

Sample Items from Whole-Class Discussion Survey

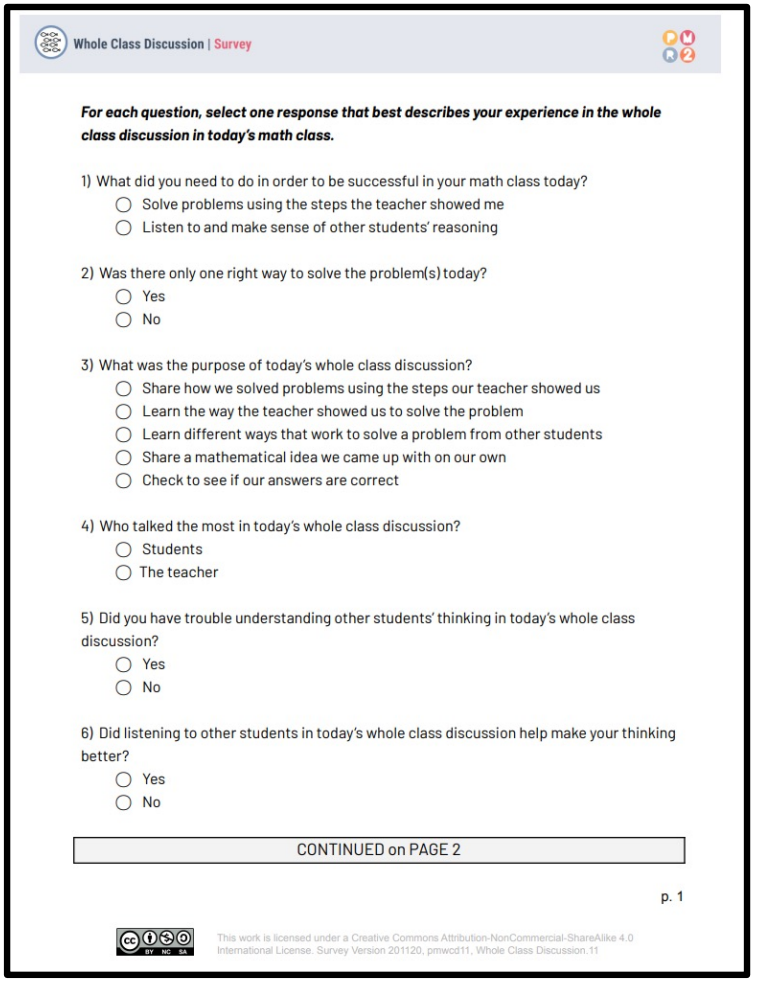
Cognitive demand of the task as implemented
Example item: What did you need to do to be successful in your math class today?

What students are accountable for in the discussion
Example item: What was the purpose of today's whole class discussion?

Extent to which discussions focus on students' ideas
Example item: Who talked the most in today's whole class discussion?

Opportunities for students to listen to, reason about, and make sense of others' ideas
Example item: Did you have trouble understanding other students' thinking in today's whole class discussion?

Extent to which students want to share their ideas and feel their ideas are valued
Example item: Were you comfortable sharing your thinking in the whole class discussion today?



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- ○ Share how we solved problems using the steps our teacher showed us
- ○ Learn the way the teacher showed us to solve the problem
- ○ Learn different ways that work to solve a problem from other students
- ○ Share a mathematical idea we came up with on our own
- ○ Check to see if our answers are correct

4) Who talked the most in today's whole class discussion?
- ○ Students
- ○ The teacher

5) Did you have trouble understanding other students' thinking in today's whole class discussion?
- ○ Yes
- ○ No

6) Did listening to other students in today's whole class discussion help make your thinking better?
- ○ Yes
- ○ No

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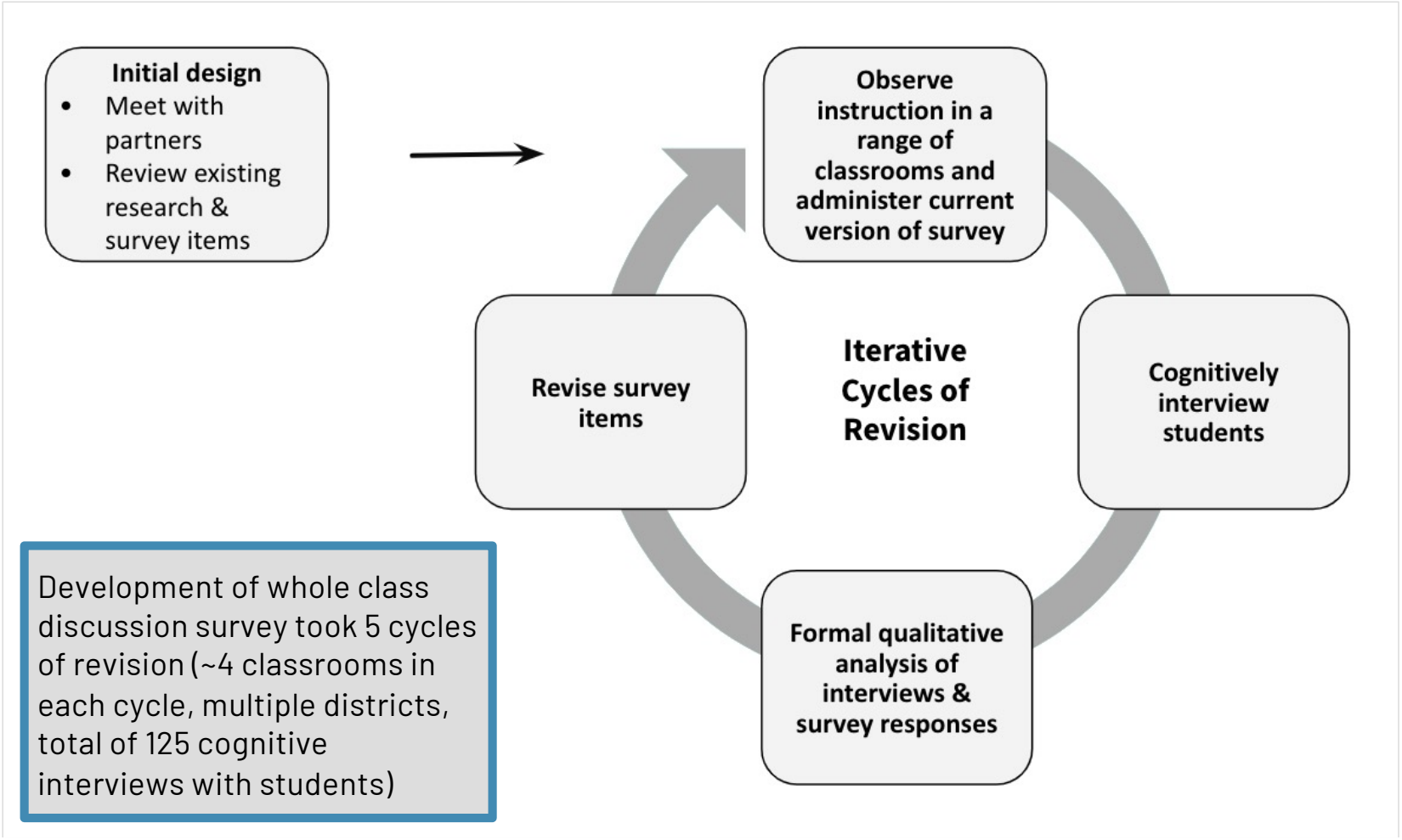
Developing the Practical Measures of Instruction



Development of whole class discussion survey took 5 cycles of revision (~4 classrooms in each cycle, multiple districts, total of 125 cognitive interviews with students)

Uses of the classroom measures in different system—wide initiatives

- One-on-one Coaching Cycles
- Job-embedded Professional Learning Workshops
- Piloting and improving curriculum guides

Three purposes of practical measures

Enhance professional learning

Determine whether a deliberate change is an improvement (in and across a system)

Enhance the coherence of instructional improvement efforts

Jackson, K., Cobb, P., Ing, M., Ahn, J., Smith, T., Kochmanski, N., Chinen, S., & Nieman, H. (in press). Developing and using practical measures to inform instructional improvement in mathematics at scale. In P. LeMahieu & P. Cobb (Eds.), *Practical measurement for improvement*. Cambridge, MA: Harvard Education Press.

Illustration: Using whole-class discussion survey to enhance professional learning

Perfect Packaging Task

…

With your partner, come up with at least 3 different box designs that could ... hold 64 cubic inches of cereal. Each box must be a rectangular prism with exactly six faces.

…

Did all of the prisms you built have the same volume? How do you know?

Which box will use the smallest amount of cardboard?

Describe the difference between surface area and volume in your own words. Be ready to share your answer with the class.

learning goal for students:
to make sense of the relationship between the volume of a rectangular prism and its surface area

goal for teaching:
to improve students' engagement in the concluding whole-class discussion

Dieteker, L. (2013, 2010). *Core Connections, Course 2* (2nd ed). Elk Grove, CA: CPM Educational Program.

Nieman, H., Kochmanksi, N., Jackson, K., Cobb, P., & Henrick, E. (2020). Student surveys inform and improve classroom discussion practices. *Mathematics Teacher: Learning and Teaching Pre-K – 12, 113*(12), pp. 91 – 99.

Illustration: Using whole-class discussion survey to enhance professional learning

Take a look at the survey data.

What stands out? What are the students telling you about their experiences in the whole class discussion?

initial goal for teaching:
to improve students' engagement in the concluding whole-class discussion

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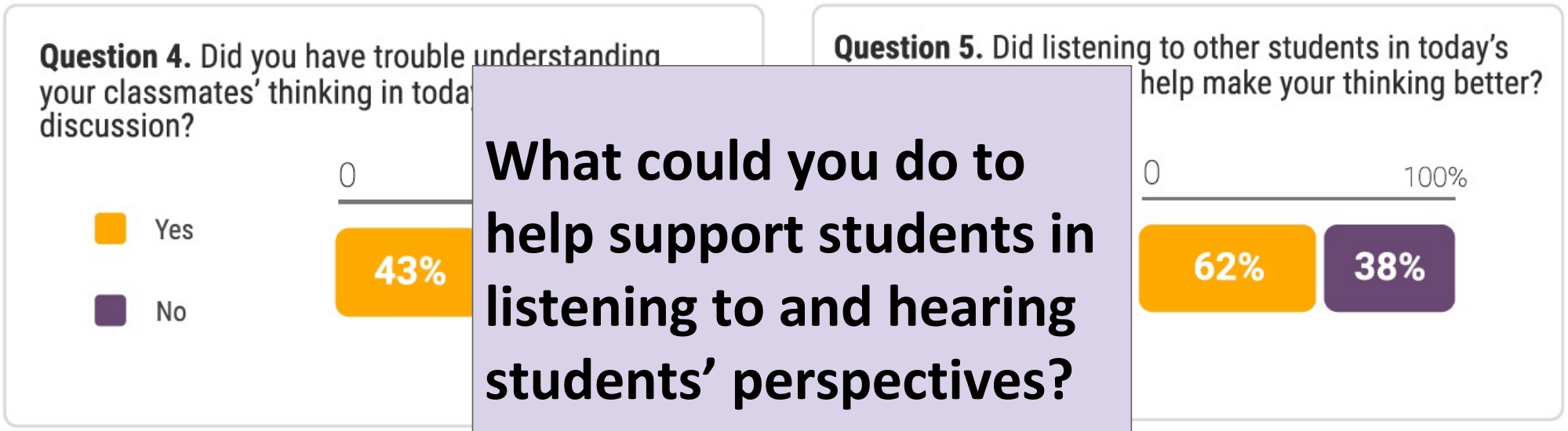
Illustration: Using whole-class discussion survey to enhance professional learning



What could you do to help support students in listening to and hearing students' perspectives?

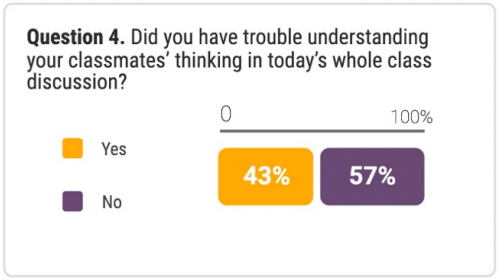
n = 21

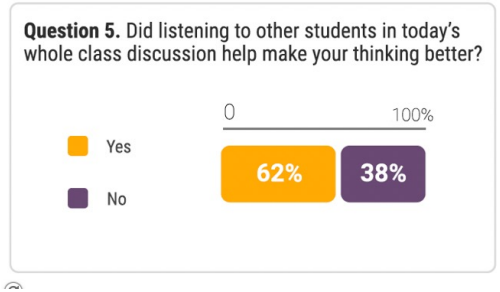
Nieman, H., Kochmanksi, N., Jackson, K., Cobb, P., & Henrick, E. (2020). Student surveys inform and improve classroom discussion practices. *Mathematics Teacher: Learning and Teaching Pre-K – 12, 113*(12), pp. 91 – 99.

Illustration: Using whole-class discussion survey to enhance professional learning

initial goal for teaching:
to improve students' engagement in the concluding whole-class discussion

revised goal for teaching:
to press students to rephrase the ideas that others shared





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Three purposes of classroom practical measures

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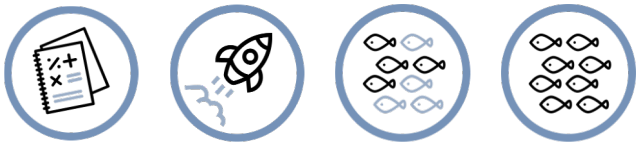
Determine whether a deliberate change is an improvement (in and across a system)

Enhance the coherence of instructional improvement efforts

System of Practical Measures, Representations, & Routines

Practical measures of key aspects of **classroom instruction** that research has linked to student learning



Practical measures of key aspects of **professional learning** (e.g., one-on-one coaching, collaborative professional learning) that research has linked to teacher learning

Practical measure of collaborative professional development

- Takes the form of a survey administered to **teachers** after taking part in professional learning

- Provides **facilitators** of professional learning with **immediate, actionable feedback** about features of **collaborative professional learning experiences that research indicates matter for teacher learning**

- Can be used to **track changes in teachers' experiences over time, in relation to changes facilitators make to their practice**

features of high-quality collaborative professional learning experiences

Look at the collaborative professional development survey.

- **Imagine the last collaborative professional development you participated in, facilitated, or observed? How would you have responded? How do you think teachers would have responded to this survey?**

- **What can you learn from this?**

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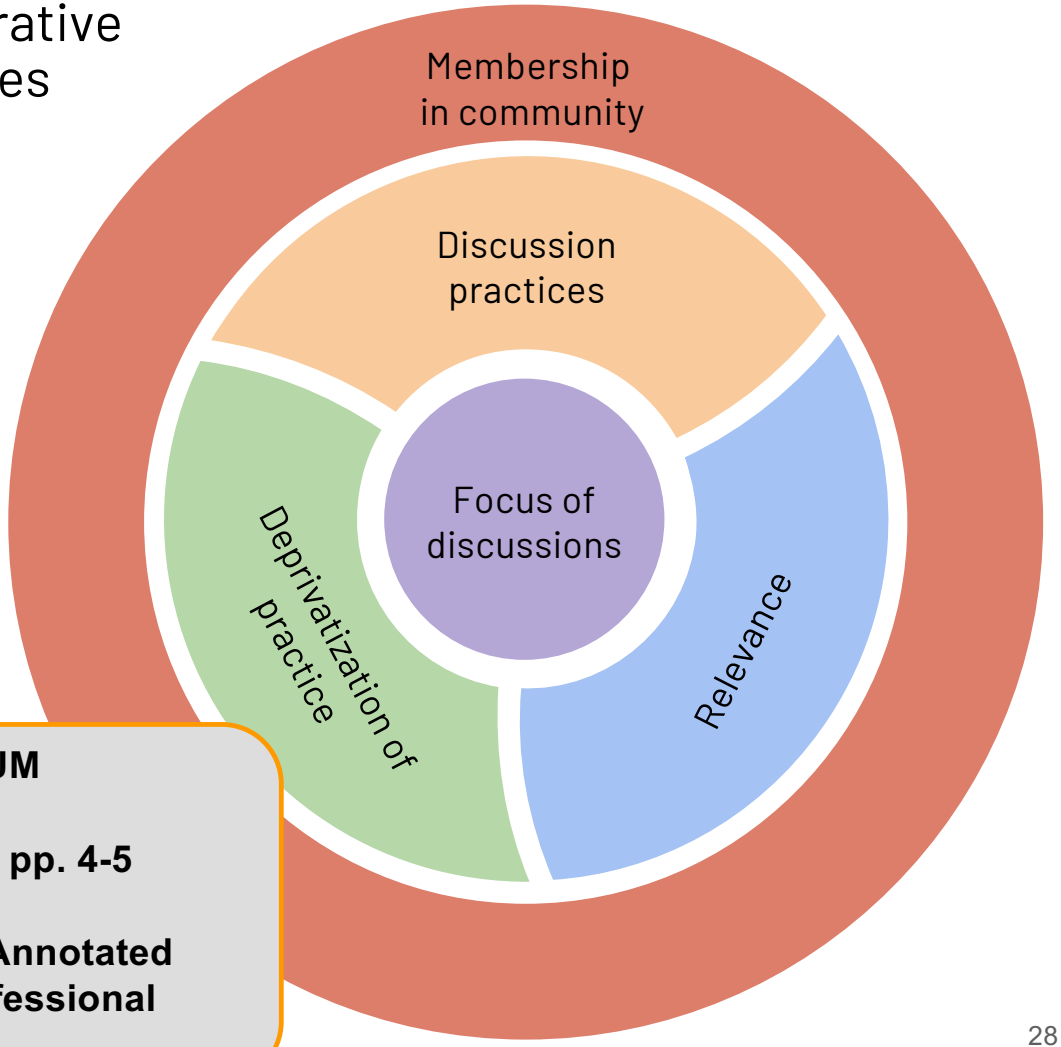
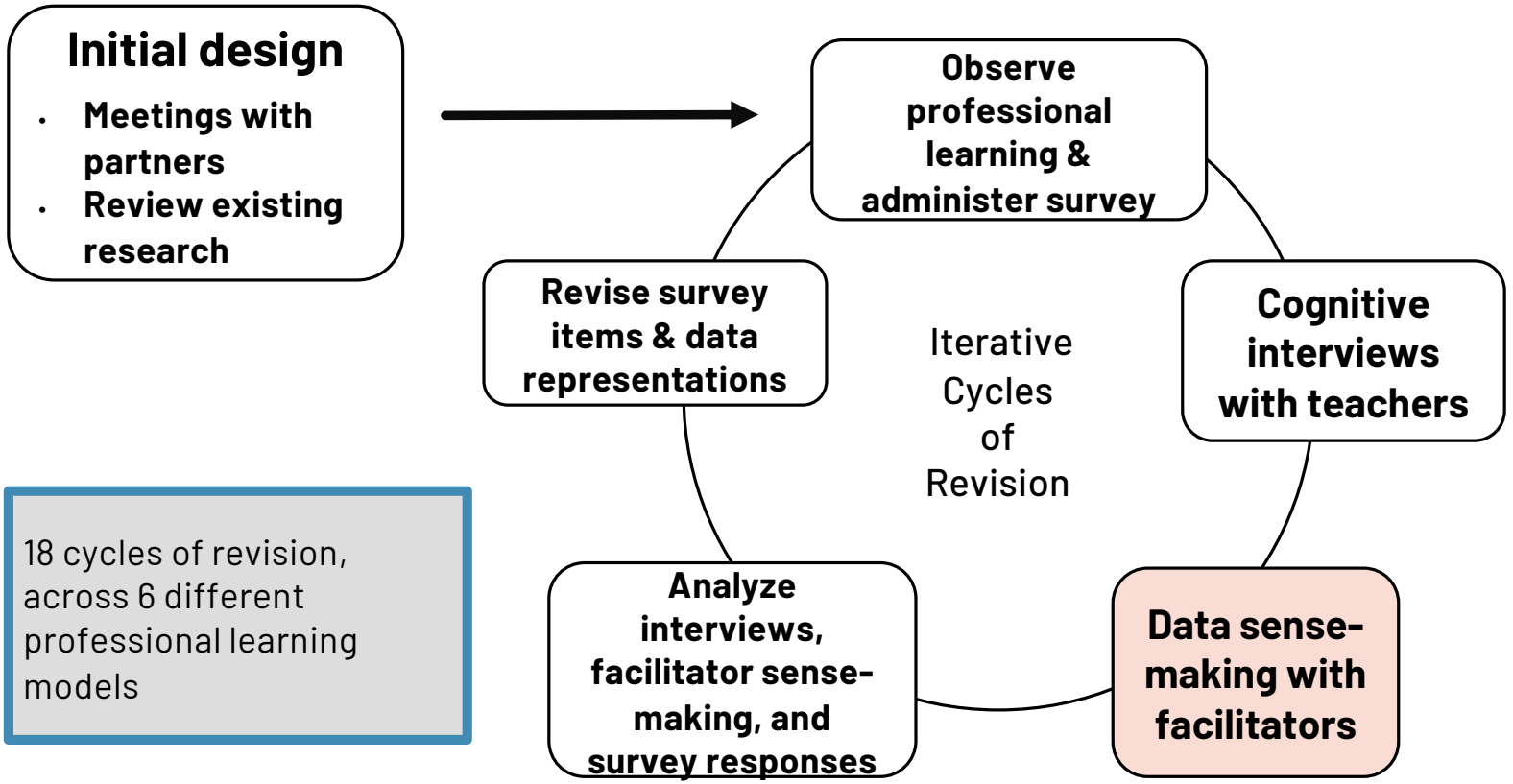
Additional info: "Annotated Collaborative Professional Learning Survey"



Development Process for Measures of Professional Learning



18 cycles of revision, across 6 different professional learning models

Illustration: Using collaborative PD practical measure to determine whether a change (in facilitation) is an improvement

Middle grades, school-wide mathematics professional learning community

- March 8: 5 teachers + 1 student teacher
- April sessions x 2 (survey not administered)
- May 10: 5 teachers

Facilitated by an experienced outside professional learning facilitator

Look at the sample survey data.

What do you notice? What do you wonder?

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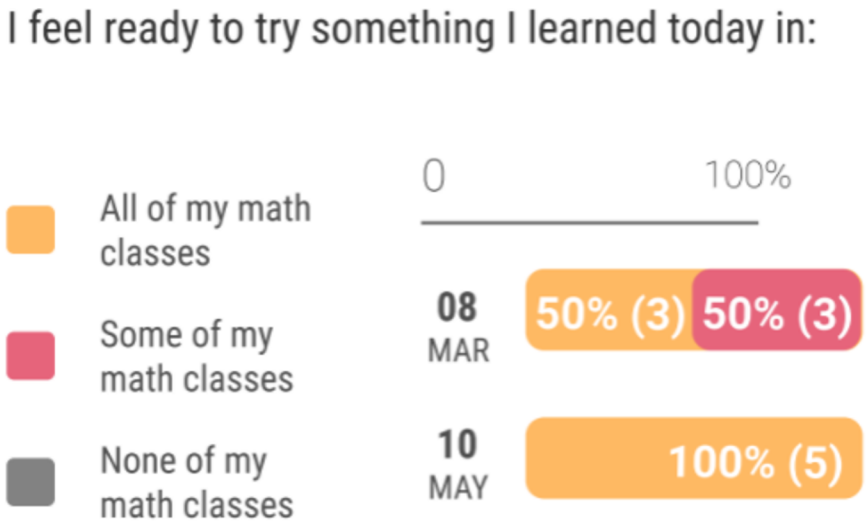
NCUM_Handouts: p.6

Nieman, H., Jackson, K., Jarry-Shore, M., Borko, H., Kazemi, E., Chinen, S., Lenges, A., Yilmaz, Z., & Haines, C. (2022, February). Using a tool that assesses teachers' experiences of collaborative professional development to inform and improve facilitation. *12th Congress of the European Society for Research in Mathematics Education*, Bozen-Bolsano, Italy.

Illustration: Using collaborative PD practical measure to determine whether a change (in facilitation) is an improvement

viewing the change between the **March 8** and **May 10** survey administrations



"I'm glad. Glad is not the right word. I'm almost relieved to see that change from some of my classes to all of my classes."

(facilitator, in-the-moment)

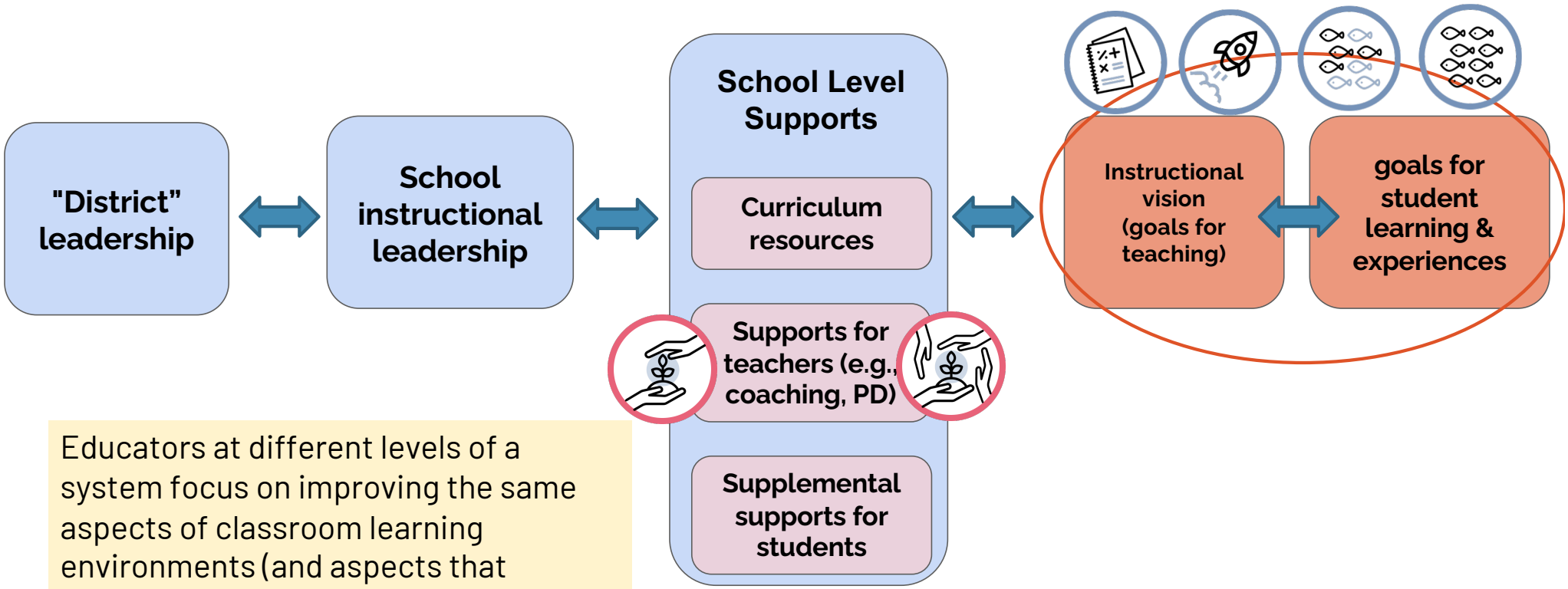
Three purposes of practical measures

Enhance professional learning

Determine whether a deliberate change is an improvement (in and across a system)

Enhance the coherence of instructional improvement efforts

Using practical measures to enhance the coherence of instructional improvement efforts



Educators at different levels of a system focus on improving the same aspects of classroom learning environments (and aspects that matter!)

Stepping back …. Improving mathematics teaching and learning at some scale requires …

- Collective learning and coherent systems of support for all educators in a system
- Intentional mapping backwards from our goals for students' learning & experiences + a vision of high-quality instruction to design potentially productive instructional improvement strategies
- Tools and routines to support the implementation of the strategies, so that we can learn rapidly how the strategies are playing out, and improve them
- Genuine partnerships between educators and researchers (especially so we can learn *across* systems and contexts)

Shout Out to Our Incredible Team!

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Hilda Borko & Michael Jarry-Shore
Stanford University

Kara Jackson, Anita Lenges, Hannah Nieman, Starlie Chinen, Maria Hays, & Elham Kazemi
University of Washington

Fabio Campos
New York University

Nick Kochmanski
University of North Carolina-Greensboro

Kara Jackson
karajack@uw.edu

Middle-School Mathematics & the Institutional Setting of Teaching
http://vanderbi.lt/mist

Practical Measures website (including information on how to download measures, etc.)
https://www.pmr2.org

Link for resources from today's session: **http://bit.ly/JacksonNCUM**