Better Math Teaching Network

Carnegie Foundation Summit on Improvement in Education

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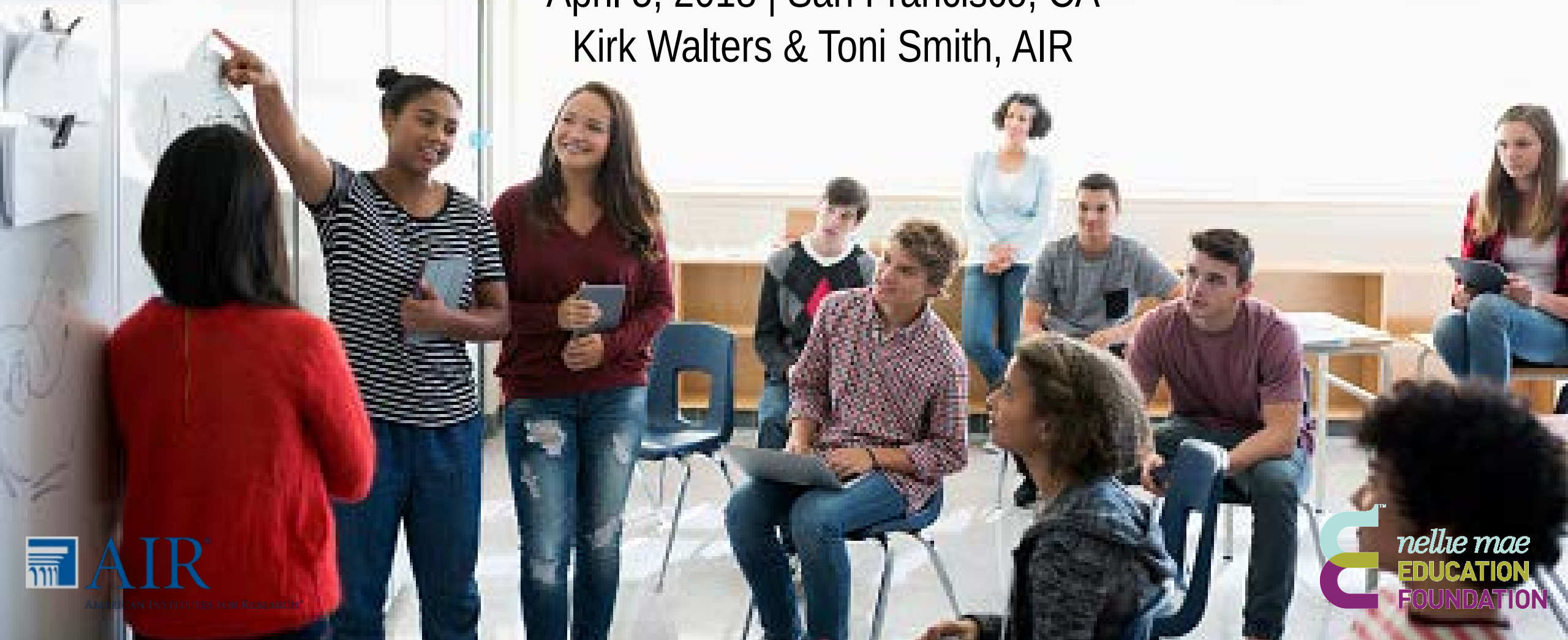

AIR
American Institutes for Research

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Overview

- Why we formed a NIC
- How we prepared to launch
- How we launched
- What our work looks like in action
- What we've been learning
- Short video

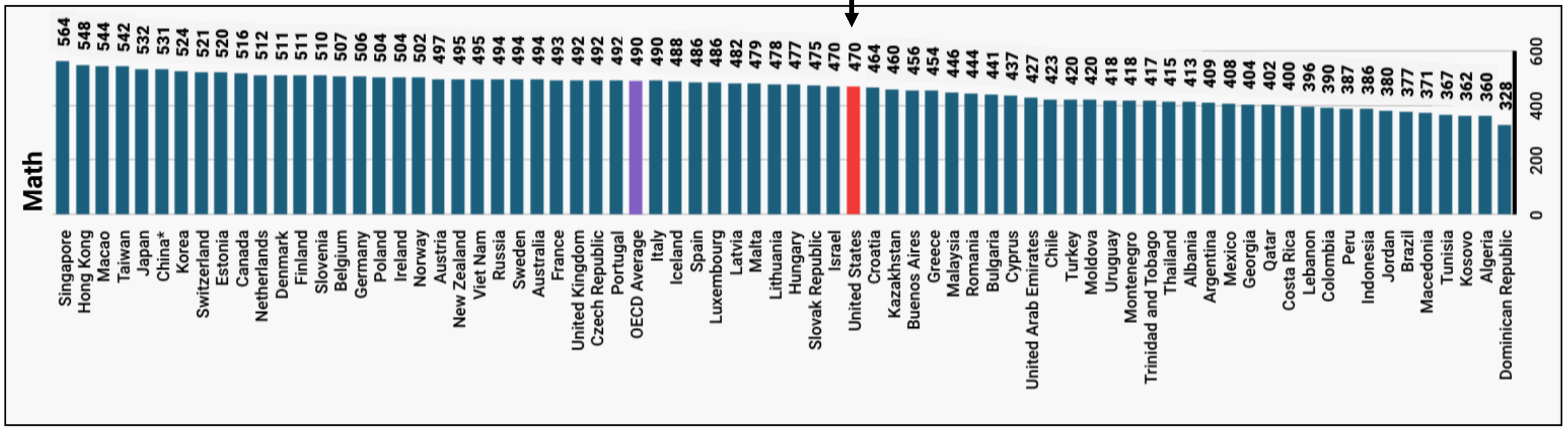
Why we formed a NIC

We identified a problem

"Big deal, an A in math. That would be a D in any other country."

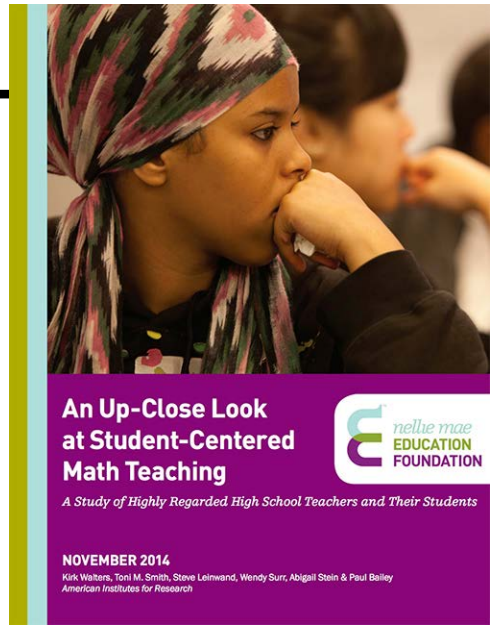
No seriously, we have a problem

We’re below the middle of the international pack on the PISA (2015), a test that matters



We then decided to study it

- Inspired by **student-centered pedagogy**, but not interested in re-igniting the "math wars"
- Finding 1: Student-centered teaching is **nuanced**, with multiple entry points for teachers
- Finding 2: **Positive association*** between student-centered instruction and students' problem-solving skills (PISA)



[High School Math Teaching Study](#)
(2014)

And we didn’t want our report to collect dust

How can we support teachers in improving their instruction by using more student-centered approaches?

And we didn't want "any old" PD program

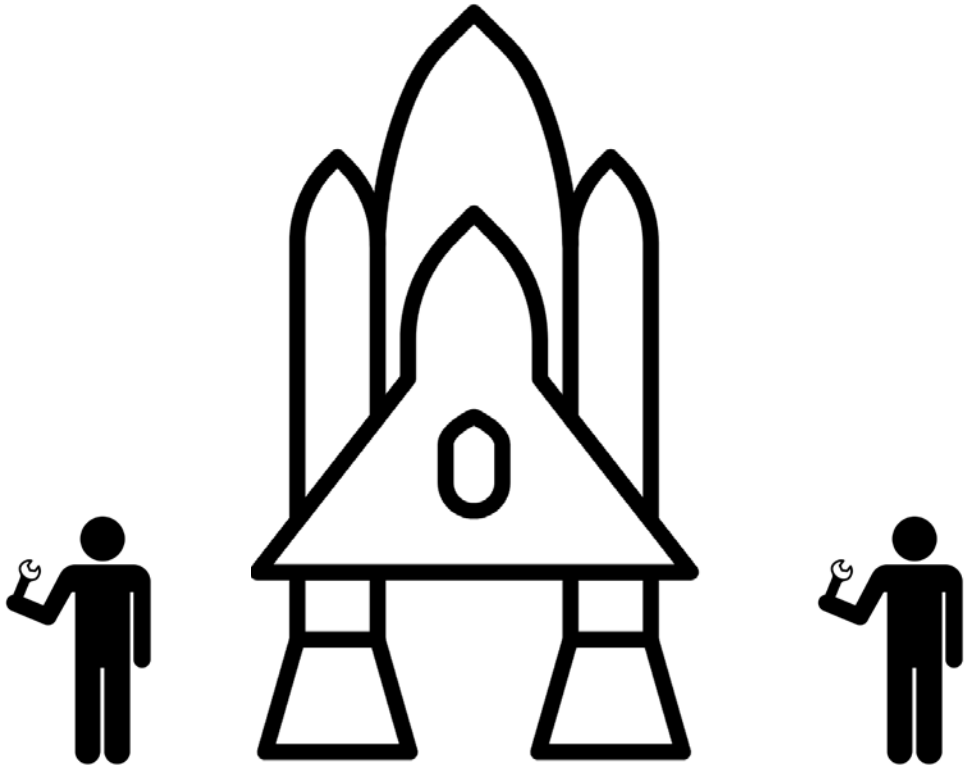
- Limited evidence on math professional development programs that work
  - Including some of our own studies

- One potentially promising direction is PD that is strongly rooted in teachers' daily work

Networked Improvement Communities

- Professional development grounded in teachers' work
  - Focus on instructional routines as standard work processes
- Foster collaboration and learning across schools and contexts
- Encourages incremental change with reflection
- More deliberate attention to data than teachers typically do when reflecting
- Opportunity to link research and practice

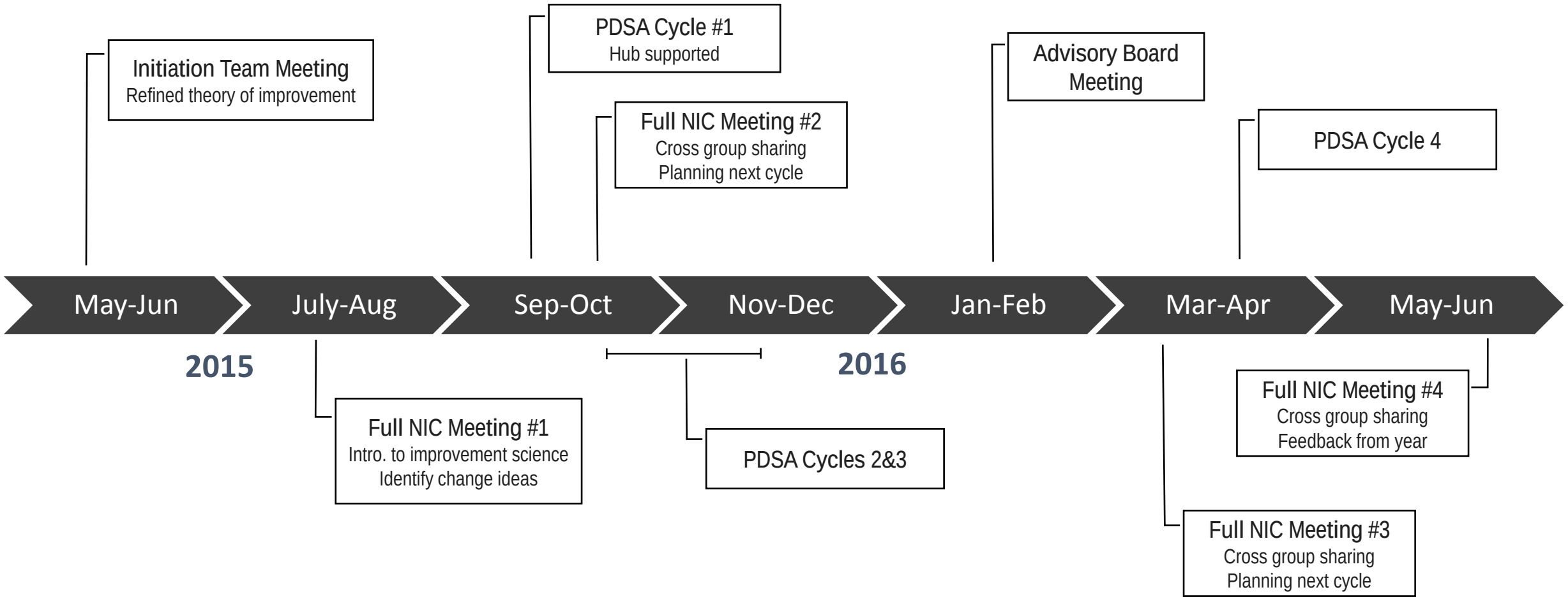
How we prepared to launch



We started small and purposefully

- Hub members participated in Learning Lab (2015-16)
  - 3 researchers and 1 practitioner
  - Alternating periods of planning and action
- Worked with initiation team to plan (spring 2015)
  - 4 math instructional leaders
  - 3 high school math teachers
- Expanded into a pilot network (fall 2015-16)
  - 3 math instructional leaders
  - 10 high school math teachers

The work


Initiation Team Meeting
Refined theory of improvement
PDSA Cycle #1
Hub supported
Full NIC Meeting #2
Cross group sharing
Planning next cycle
Advisory Board Meeting
PDSA Cycle 4
May-Jun
July-Aug
Sep-Oct
Nov-Dec
Jan-Feb
Mar-Apr
May-Jun
2015
2016
Full NIC Meeting #1
Intro. to improvement science
Identify change ideas
PDSA Cycles 2&3
Full NIC Meeting #4
Cross group sharing
Feedback from year
Full NIC Meeting #3
Cross group sharing
Planning next cycle

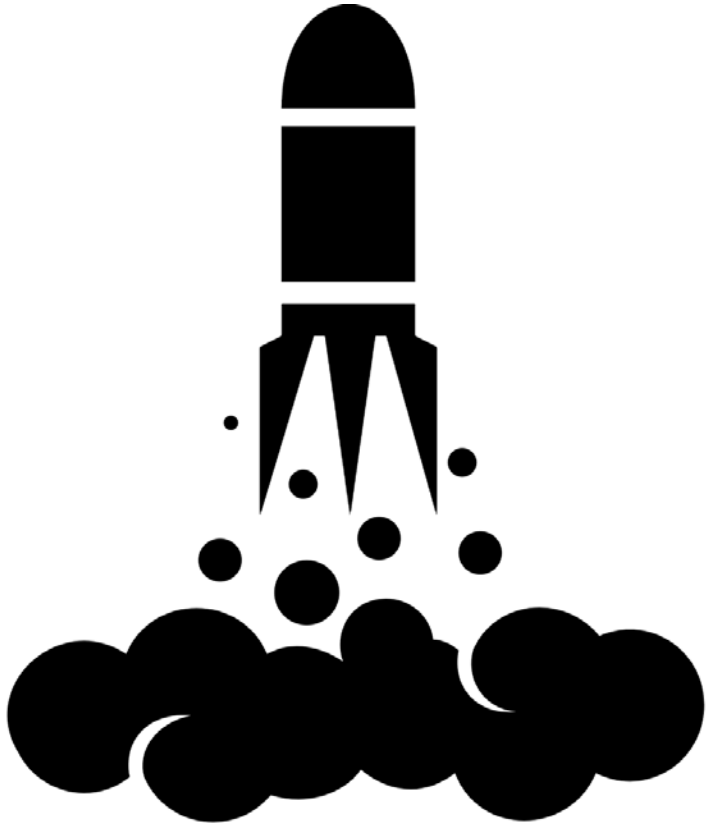
What we learned

- Teachers
  - Liked the network focus on student-centered instructional routines to more deeply engage students
  - Needed time to reflect on instruction and identify an aspect to change
  - Benefited from the support of an improvement science coach to plan, design, and collect data for PDSA testing
- Refining the aim and driver diagram are ongoing processes

What we learned (continued)

- The network is best supported by a combination of small- and whole-group meetings
  - Small PDSA testing groups (3-4 teachers) focused on a similar change idea and facilitated by a hub “coach”
  - Periodic whole-group meetings to share and learn from each other
- Instructional leaders should be organized into a separate group focused on spreading the work

Launching the BMTN



Our aim statement

2,019 in 2019:

By 2019, the number of students who *connect*, *justify*, and *solve* with depth in algebra will increase by 2,019.

Deep student engagement

- *Connect*. Make connections among mathematical algorithms, concepts, and application to real-world contexts, where appropriate
- *Justify*. Communicate and justify mathematical thinking as well as critique the reasoning of others
- *Solve*. Make sense of and solve challenging math problems that extend beyond rote application of algorithm

AIM Statement

Deep Student Engagement in Algebra

2,019 in 2019:
By 2019, the number of students who *connect*, *justify* and *solve* with depth in algebra will increase by 2,019.

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Connect. Make connections among mathematical algorithms, concepts, and application to real-world contexts, where appropriate.

Justify. Communicate and justify mathematical thinking as well as critique the reasoning of others.

Solve. Make sense of and solve challenging math problems that extend beyond rote application of algorithm.

Primary Drivers (WHAT?)

Mathematics Instruction

Mathematical instruction provides ongoing opportunities for all students to *connect*, *justify*, and *solve* in algebra through the *choice of task/activity* and by *shifting the academic responsibility to the students.*

(Instruction is student-centered.)

Classroom Environment

Positive, caring learning environment for all students

Student Attitudes

Students see school and learning as important and valuable

Student Readiness

Students enter algebra with the requisite knowledge, skills, and dispositions to succeed

Secondary Drivers (WHERE?)

Instructional Routines to Introduce New Material

Instructional Routines to Practice/Reinforce Previously Introduced Material

Change Ideas (HOW?)

BETTER MATH TEACHING Network

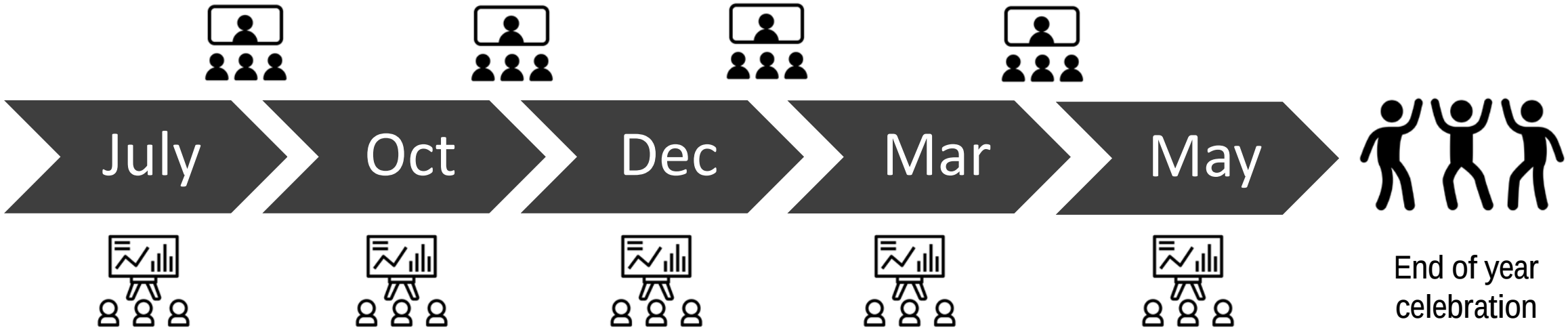
Network members

- Recruitment
  - High school algebra teachers
  - Reflective, interested in student-centered instruction, desire to improve
- Growing over time
  - Year 1 (2016-17) - 23 teachers, 5 instructional leaders
  - Year 2 (2017-18) – 41 teachers, 10 instructional leaders
  - Year 3 (2018-19) – 55 teachers, 15 instructional leaders
- Facilitated by a hub
  - Researchers, practitioner, research assistants

Our work in action

Our basic structure

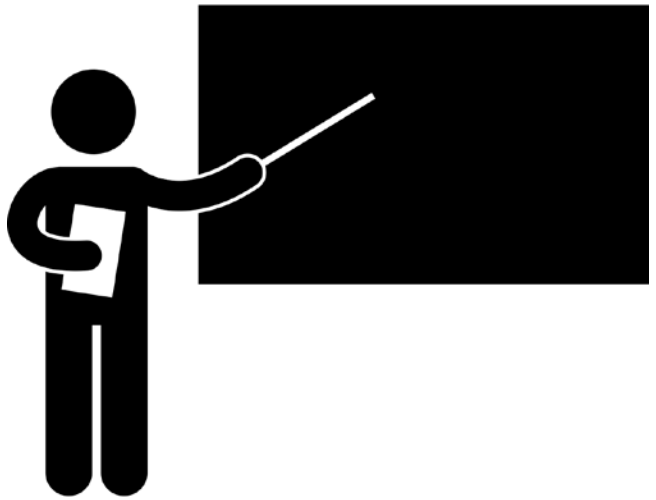
Virtual meetings every six weeks with small groups of teachers testing similar instructional routines



Five in-person meetings per year, anchored by a weeklong summer institute

What did those routines look like?

- Introducing new material using *open-ended problems* to encourage students to make connections (**Connect**)
- Providing and, ultimately, removing scaffolds for students to use *claim-evidence-reasoning* in justifications (**Justify**)
- Integrating more *non-rote problems* when new material is introduced (**Solve**)



What about the PDSA process?

- Teachers developed measures for **three key questions**
  - Will I implement the routine **as planned**?
  - Will my students **engage**?
  - Will my students engage **with depth**?

- They use different types of **data sources**
  - Teacher journal, student surveys, student work – e.g., exit ticket, observation, audio recordings of students

Examples

3. STUDY			
Questions: Questions you have about what will happen. What do you want to learn? (From Plan – Step 1)	**Predictions:** Make a prediction for each question. Not optional. (From Plan – Step 1)		**What were the results?** Comment on your predictions in the rows below. Were the correct? Record any data summaries as well.
Will my students connect with depth?	40% will score a "2" or higher on the connection rubric	→	40% scored a "2" and 10% scored a "3" for a total of 50%scoring a "2" or more

PDSA form
Connect

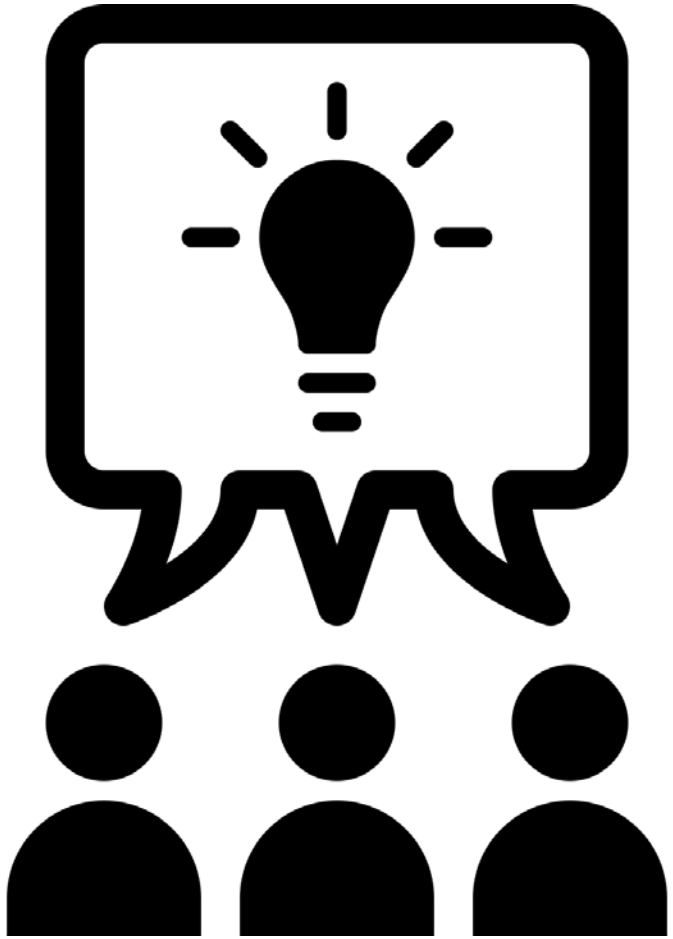
Score	Evidence
0	**No reflection attempted**
1/Beginning	• Has **no connection to the concepts** or the **meaning** underlying the procedure being used. • Cited an incorrect connection. • Explanations **focus** solely on describing the **procedure** that was used.
2/Emerging	• Explains the use of procedures for the purpose of **developing** deeper levels of understanding of mathematical concepts and ideas. • Student **engages with conceptual ideas** that underlie the procedures to **develop understanding**.
3/Connecting	• Student is able to independently explore and understand the nature of mathematical **concepts, process, or relationships.** • Student **make connections** among multiple representations to help develop meaning. • **Explains** that broad general procedures have close **connections** to underlying conceptual ideas. • Connections are logical and meaningful.

Depth of Connections Rubric
Used for each PDSA trial

Assessing our progress toward the aim

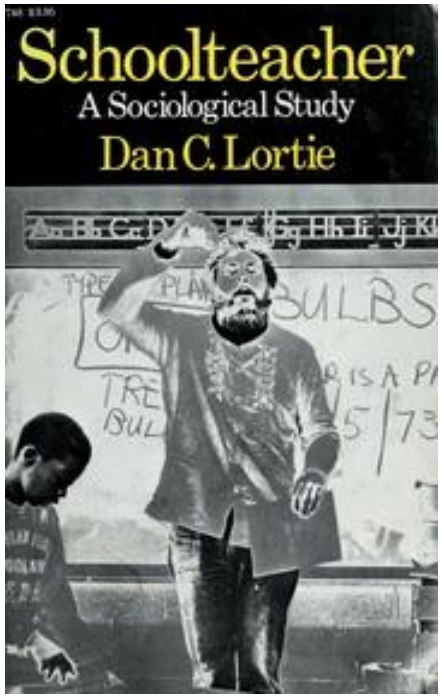
- Student **survey questions** that align with our aim (and teachers' instructional improvement efforts)
  - Ask how often students have opportunities to engage in activities to connect, justify, solve
- Administer the survey each Fall and Spring

What we've been learning



Things we learned right away

- Both new and experienced teachers told us and our external evaluator that it helped break down professional isolation
- Teachers liked the focus on instructional routines that they used weekly, sometimes daily



Teaching as an isolated profession is not new (Lortie, 1975)

Value of network learning

Opportunities to collaborate with educators from other schools and districts	98% Extremely Beneficial
Opportunities to better understand/improve my teaching	93% Extremely Beneficial
Participation in network meetings & events	90% Extremely Beneficial
I value the opportunity to be part of the BMTN	91% Strongly Agree

As we got going, it also became clear

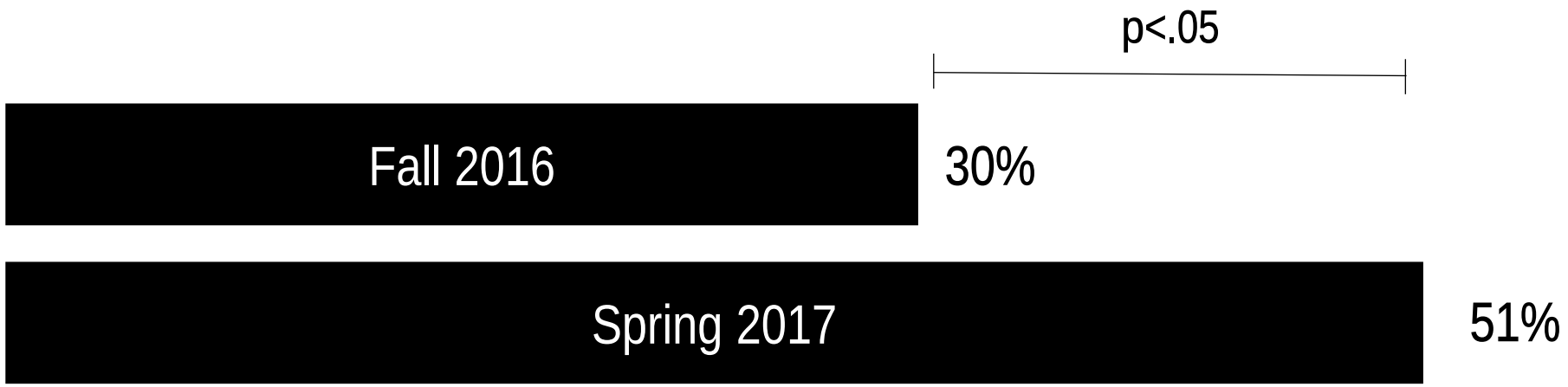
- Teachers found the **PDSA structure useful** for testing and refining instructional routines, including the narrowed focus on Connect, Justify, and Solve
- Teachers learned it was possible to deepen student engagement by making **incremental improvements** to their instruction

Challenges

- How to spread change ideas
- How to support growing network
- Measures, measures, measures
  - How to measure *deep* engagement
  - How to make *practical* measures

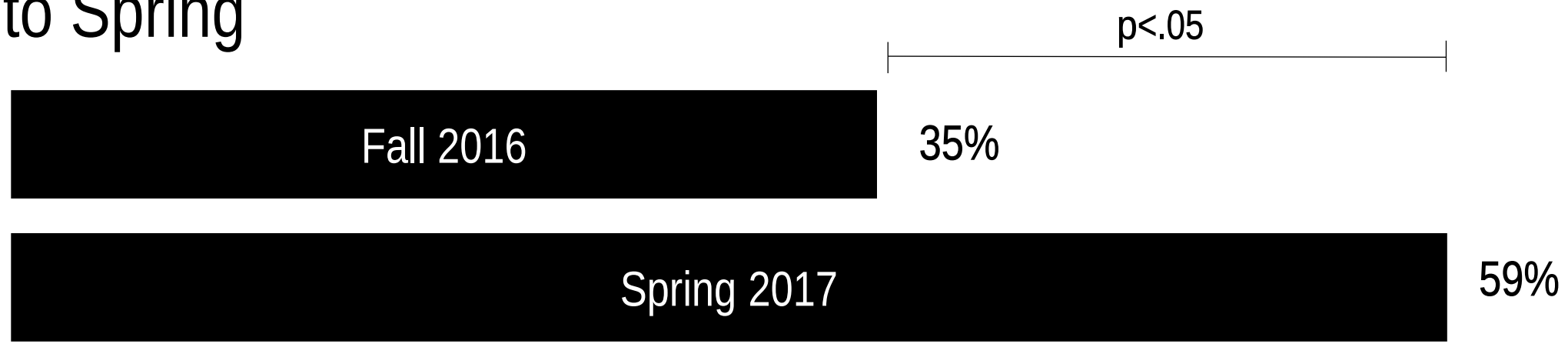
Connect

Percentage of students reporting making connections between **math and real world** on a daily basis, Fall to Spring



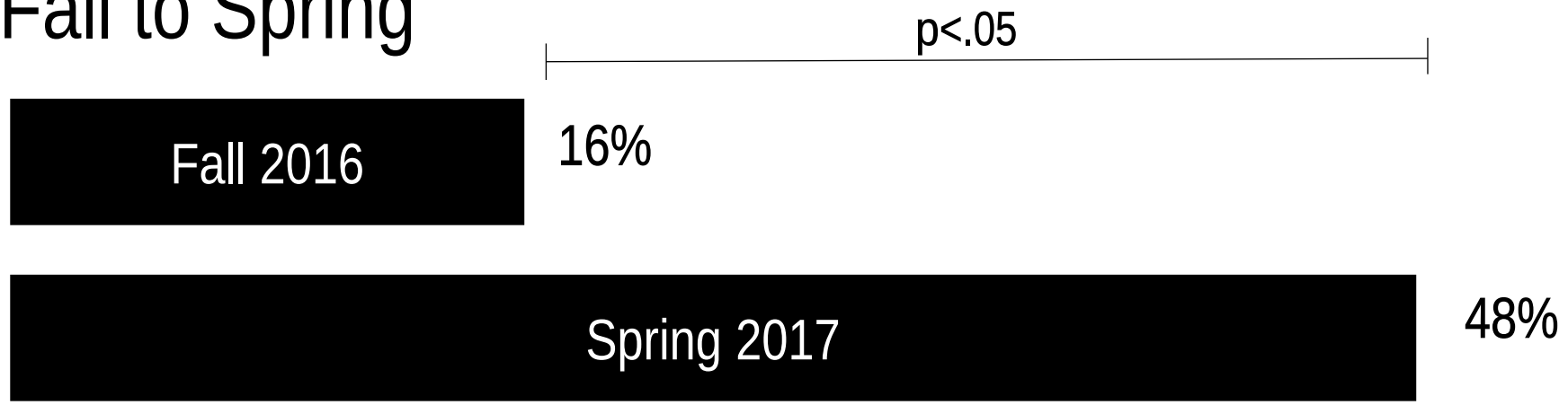
Justify

Percentage of students reporting **arguing or defending their approach** to solving math problems a daily basis, Fall to Spring



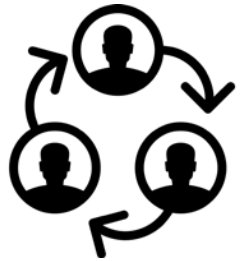
Solve

Percentage of students reporting solving **multi-step problems** that take 20+ minutes to solve on a daily basis, Fall to Spring



Our work is beginning to spread

- Refined **instructional routines** are being shared inside and outside the network
- BMTN leaders and teachers are **presenting their work** at regional and national conferences (>10 delivered, more planned)
- **Publications** are in the works



Thanks!

www.bettermathteachingnetwork.org

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