

Tapping Teachers' Talents



Suzanne Donovan, Executive Director
Strategic Education Research Partnership

National Academies
June 6, 2014

Once upon a time...







Are you or have you ever been a teacher?



Text a **CODE** to 22333

Yes

390247

No

390248

[Results](#)

For teachers: To achieve a high functioning K-12 education system, what portion of the challenge can be addressed through policies that address incentives and accountability?

📱 Text a **CODE** to 22333

0	390236
1-25	390239
26-50	390246
51-75	477655
76-100	478908

[Results](#)

For non-teachers: To achieve a high functioning K-12 education system, what portion of the challenge can be addressed through policies that address incentives and accountability?

📱 Text a **CODE** to 22333

0	478937
1-25	478939
26-50	478942
51-75	478943
76-100	478944

[Results](#)

Incentives approaches
treat teachers as
targets for changed
behavior



How People Learn

Brain,
Mind,
Experience,
and
School

NATIONAL RESEARCH COUNCIL

Fish is Fish



Leo Lionni







Three principles

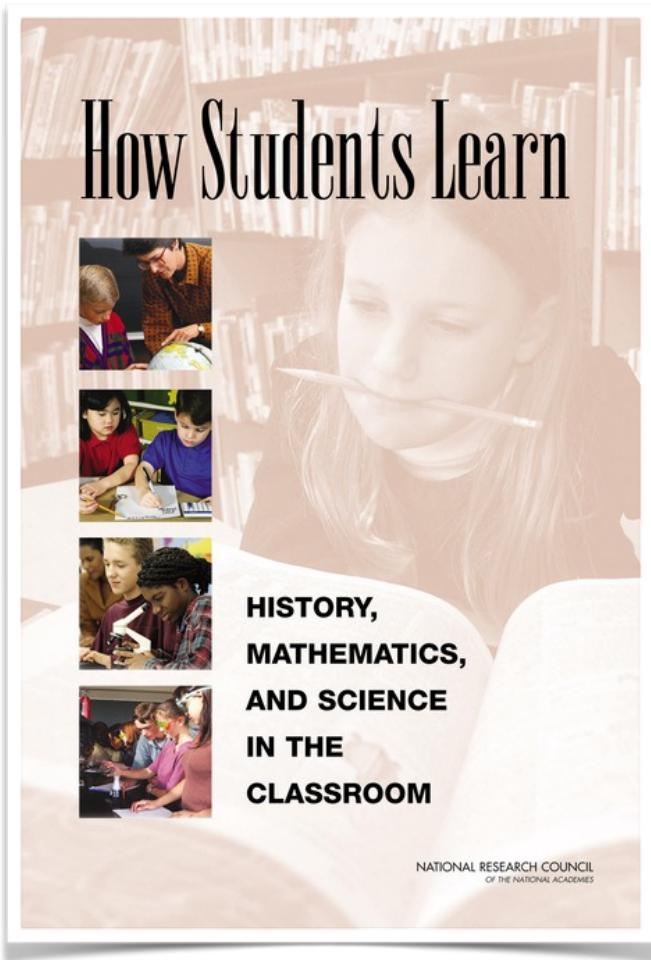
- Elicit and engage students' thinking so they can construct the targeted understanding
- Organize knowledge in a conceptual framework/ link to big ideas
- Build metacognitive skills

How People Learn

BRIDGING
RESEARCH
AND
PRACTICE

NATIONAL RESEARCH COUNCIL

11

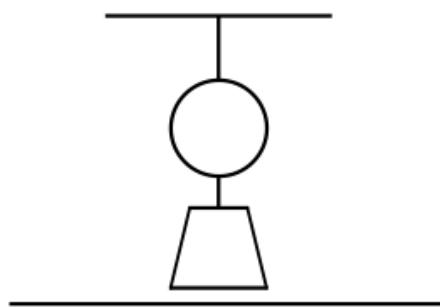


Guided Inquiry in the Science Classroom

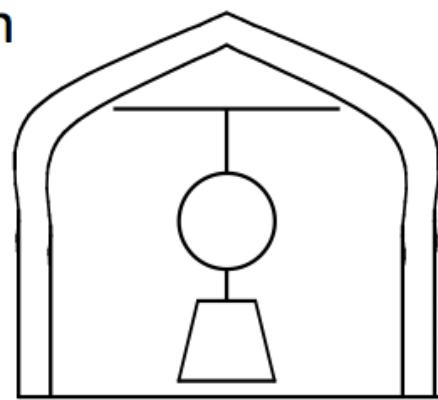
James Minstrell and Pamela Kraus

- Vacuum inside a bell jar

Nature and Effects of Gravity
Diagnostic Question



Scale reading = 10.0 lbs



Glass dome with
air removed

Scale reading = _____ lbs

Guided Inquiry in the Science Classroom

James Minstrell and Pamela Kraus

For non-teachers: What percentage of teachers can benefit from this kind of "translational" work?

📱 Text a **CODE** to 22333

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1-25	479803
26-50	479813
51-75	479814
76-100	479815

[Results](#)

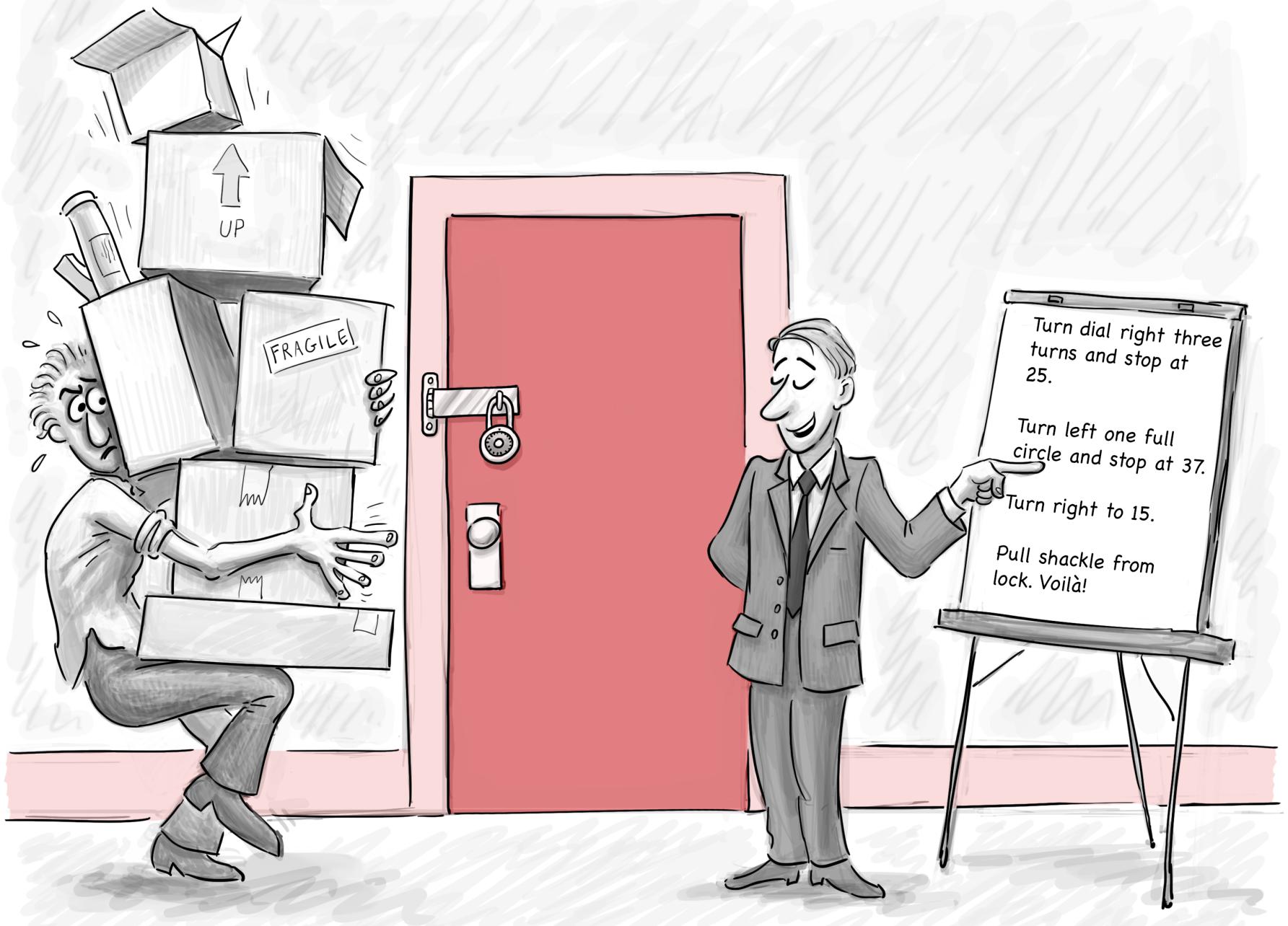
For teachers: What percentage of teachers can benefit from this kind of "translational" work?

 Text a **CODE** to 22333

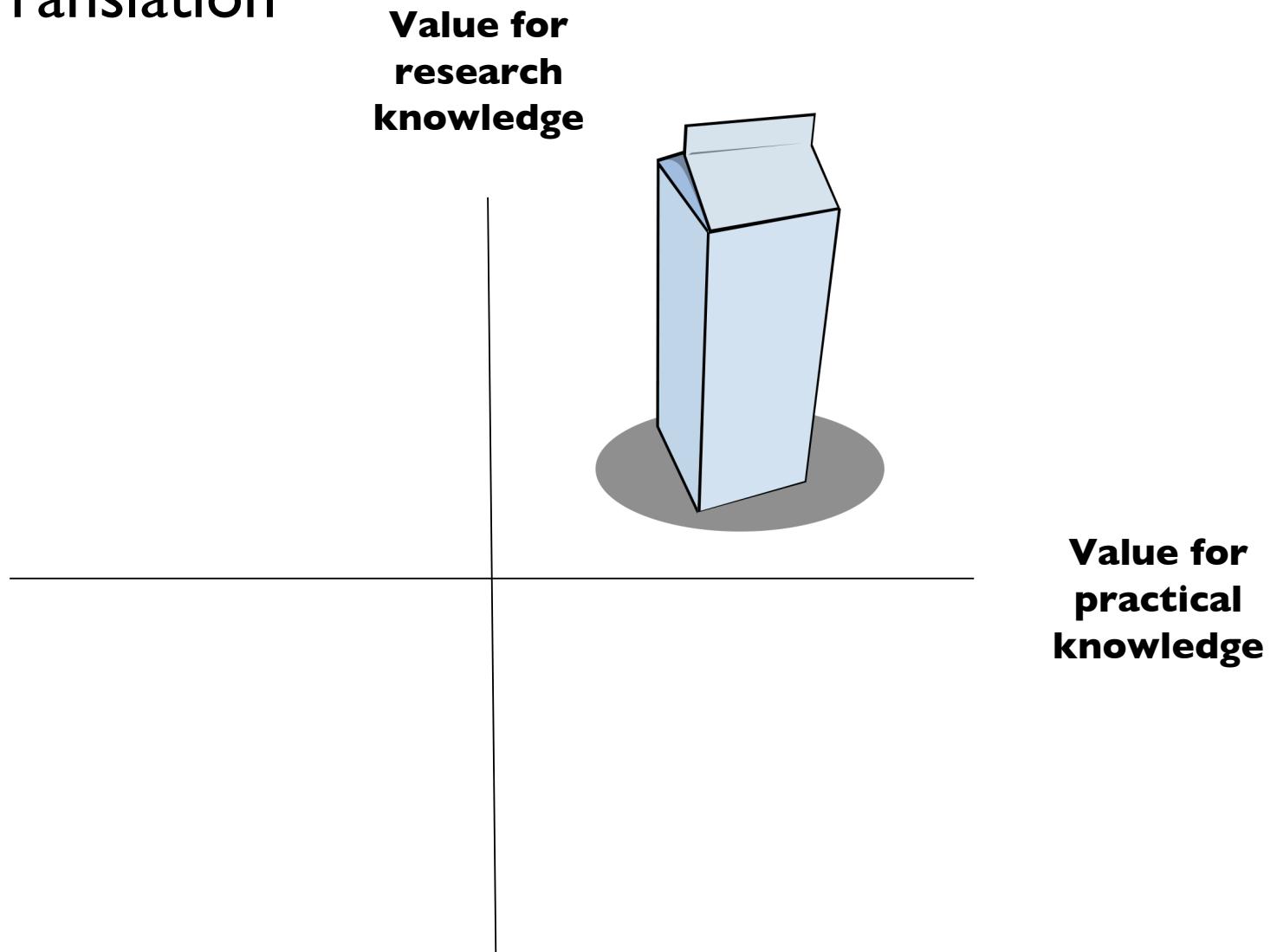
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26-50	479789
51-75	479790
76-100	479791

[Results](#)

Translational Research
treats teachers as
targets for learning

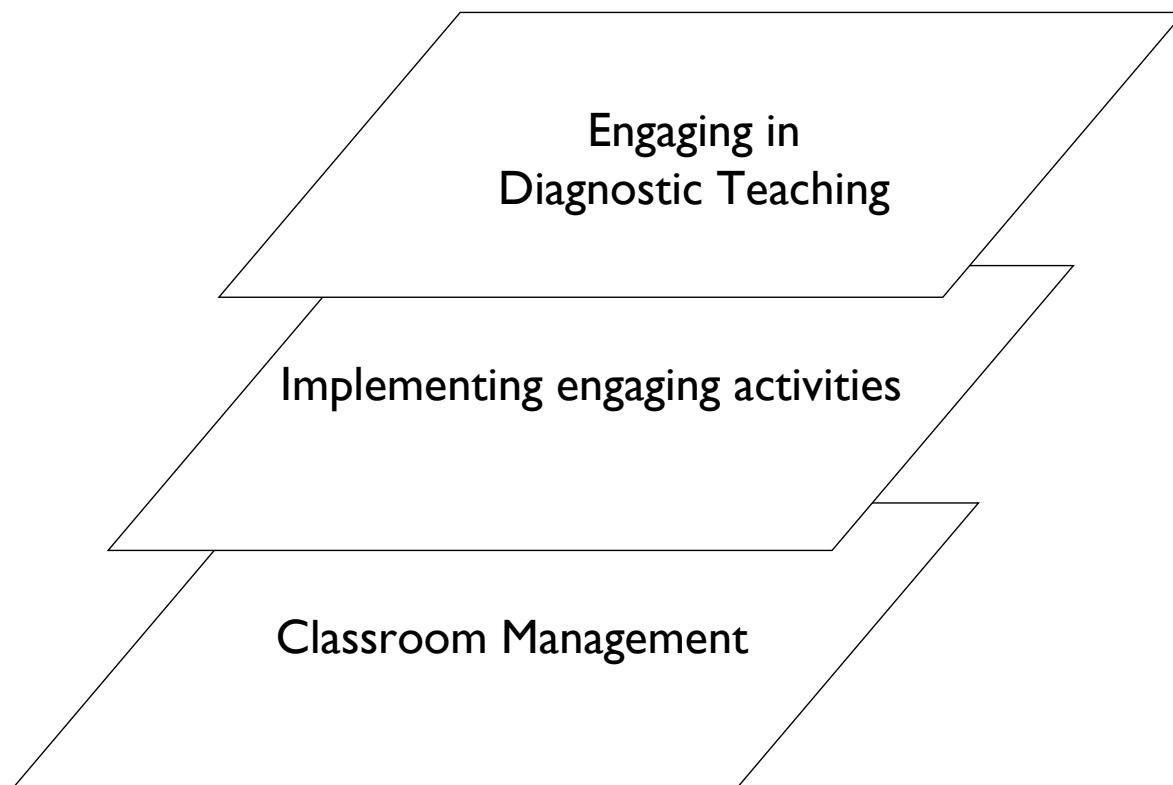


Lost in Translation

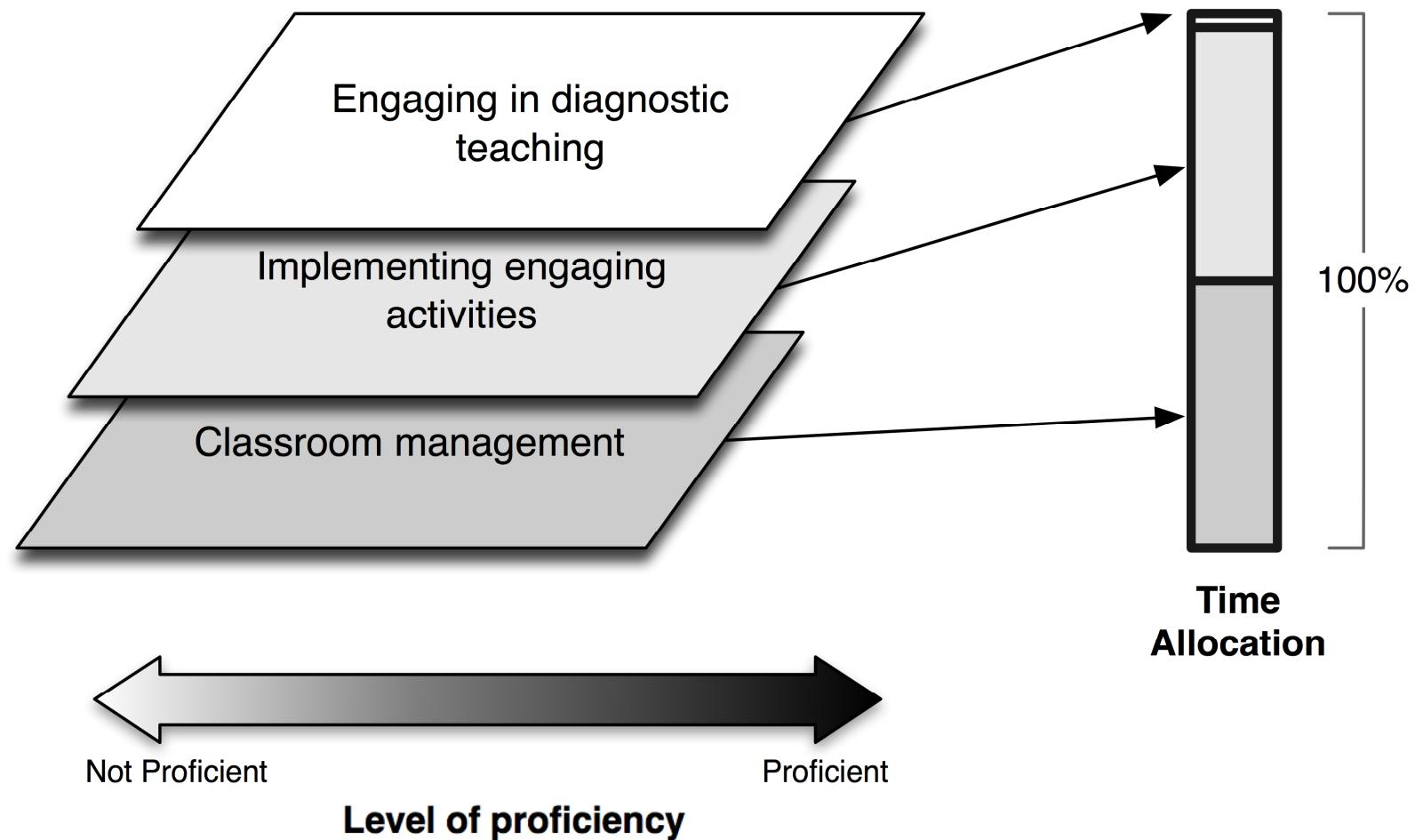


Pasteur's Quadrant

Alan Schoenfeld's Three Planes of Teaching Activity

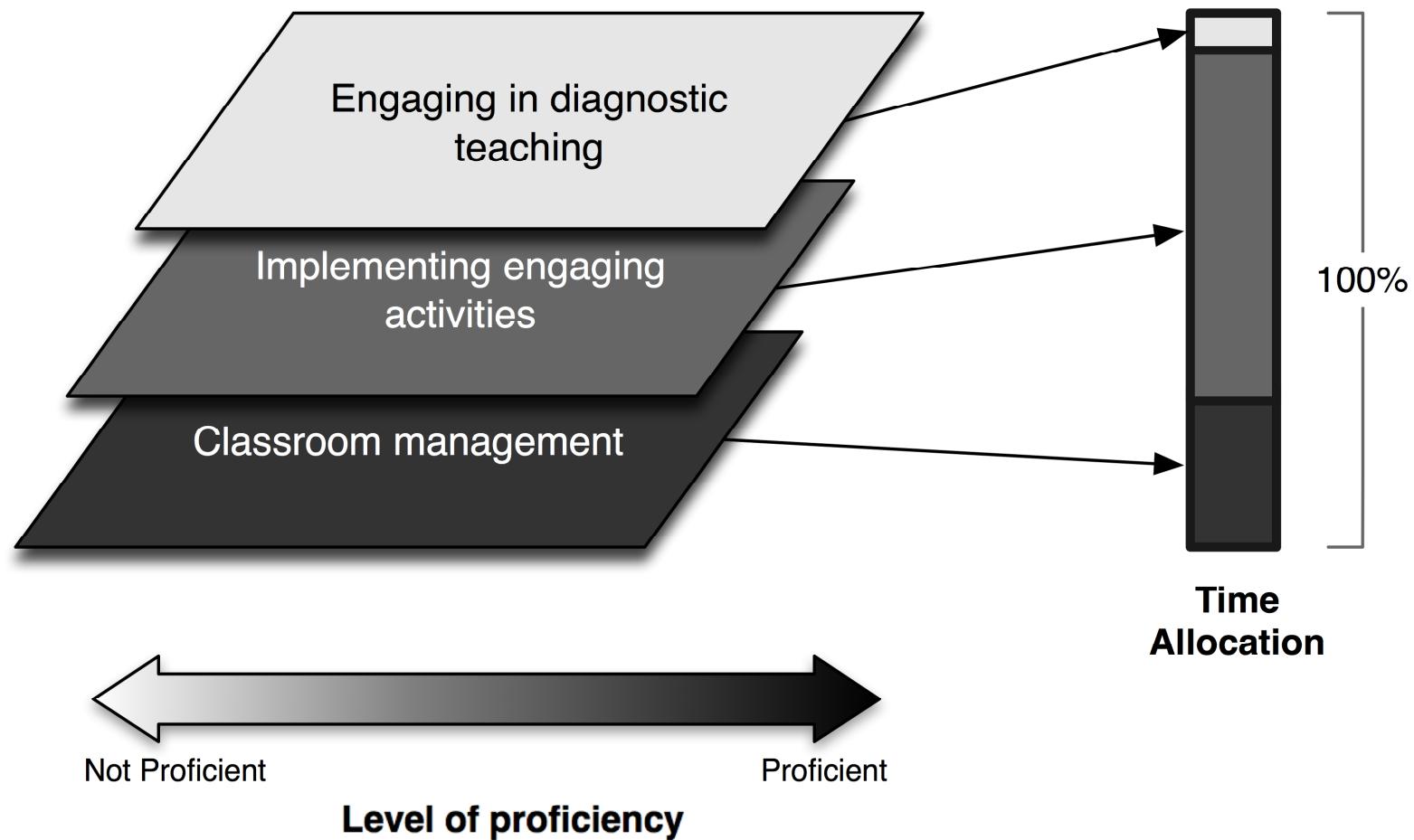


A Typical Beginning Teacher Profile



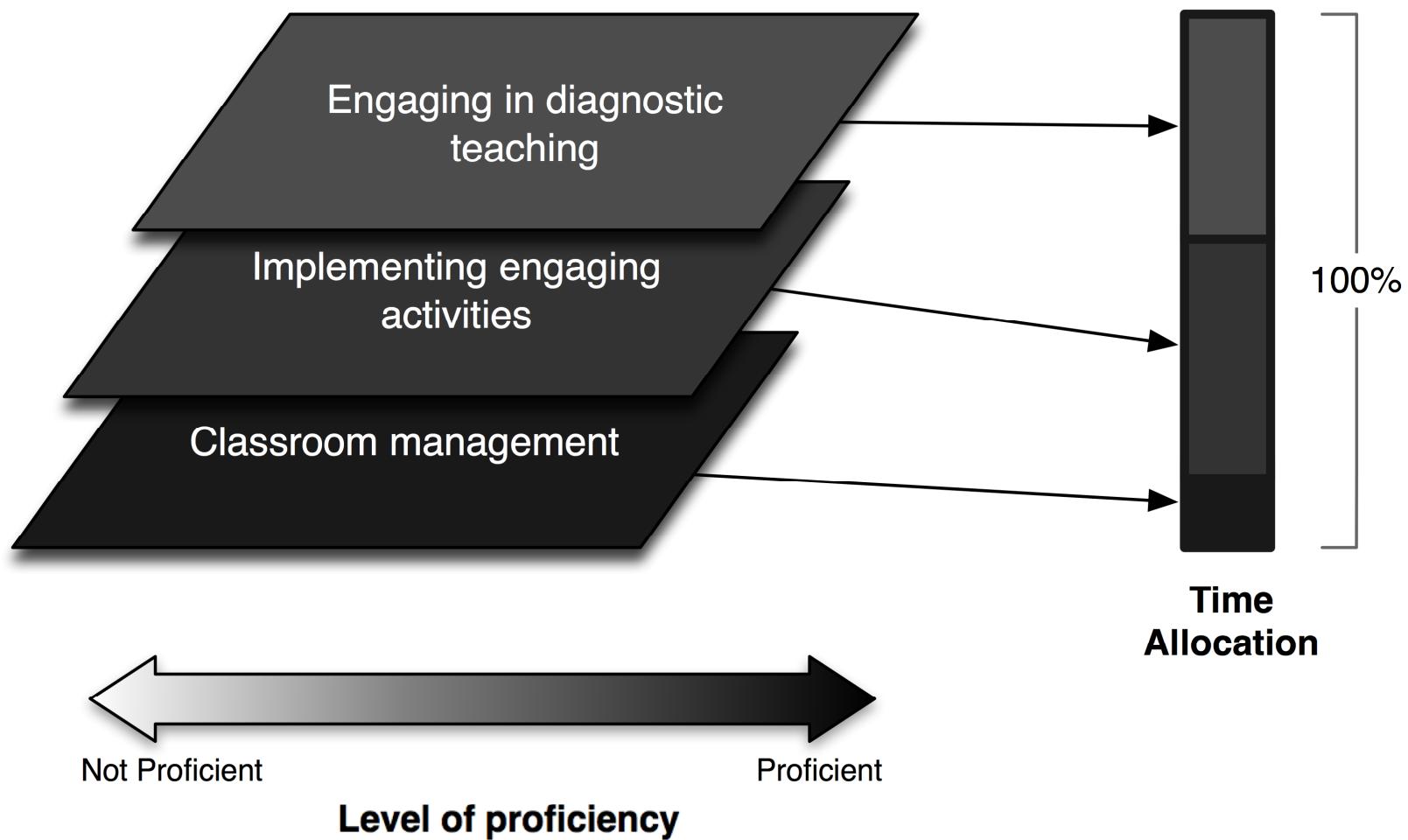
Courtesy of Alan Schoenfeld

A Typical Accomplished Teacher Profile



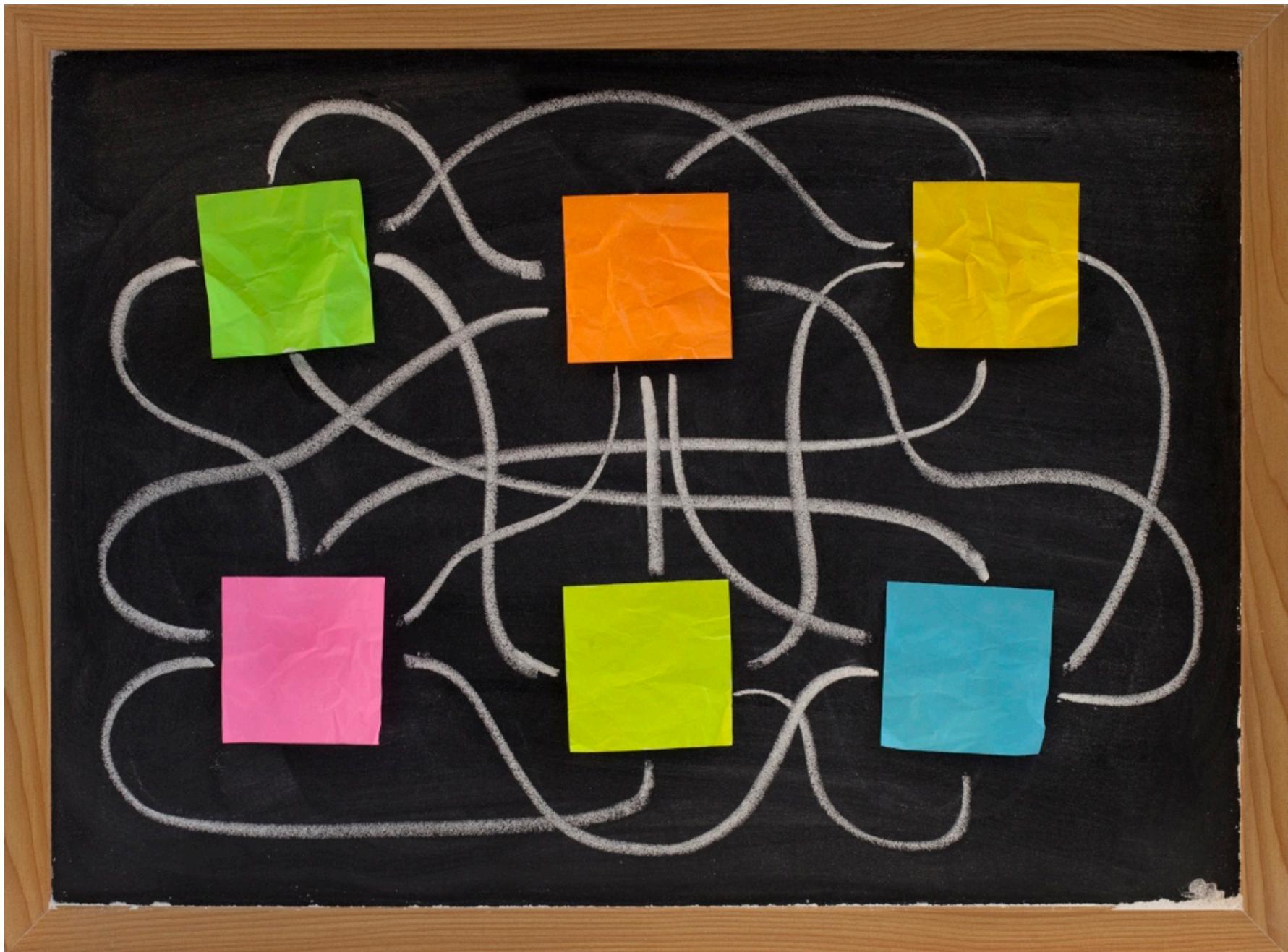
Courtesy of Alan Schoenfeld

A Typical Expert Teacher Profile



Courtesy of Alan Schoenfeld





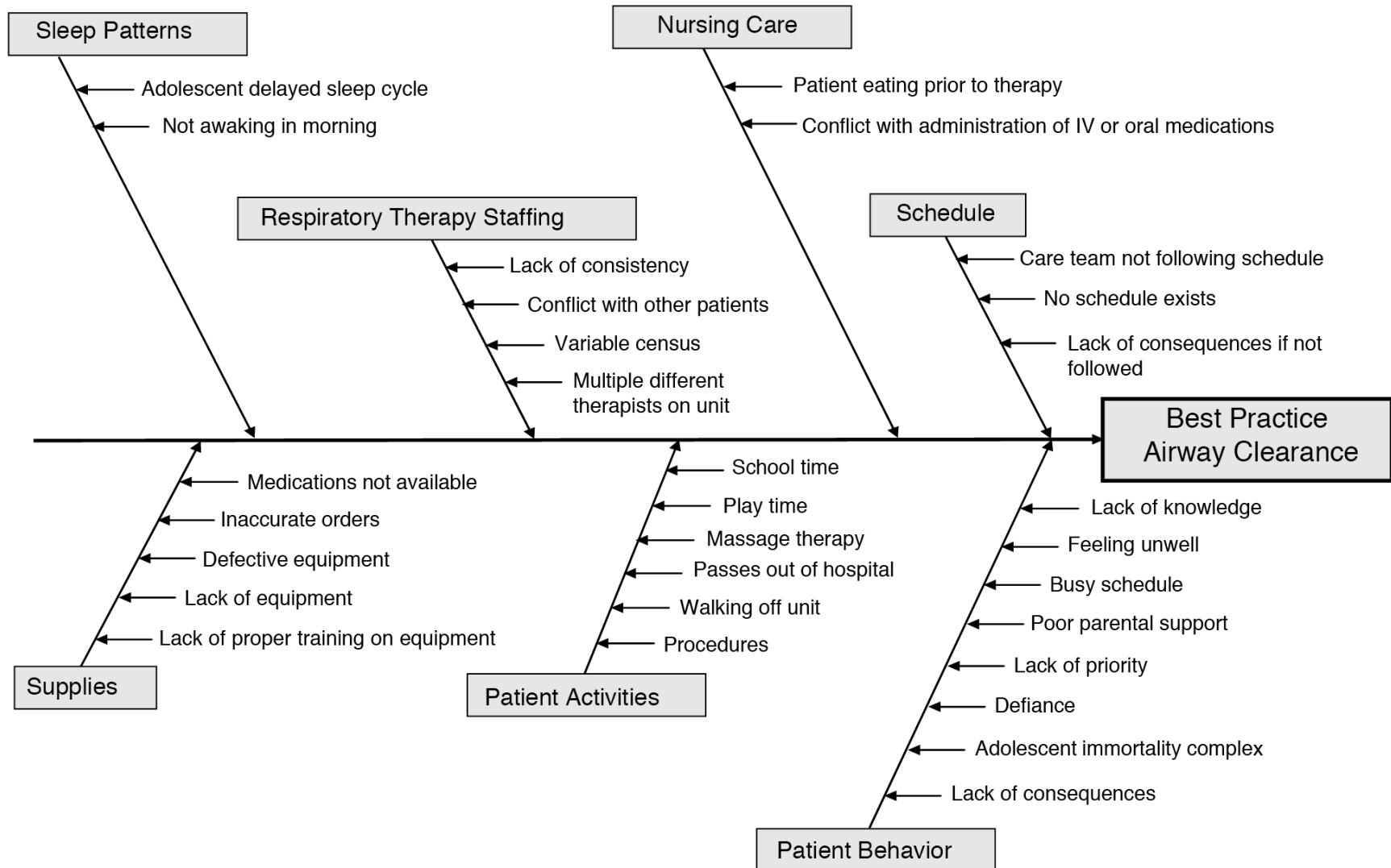
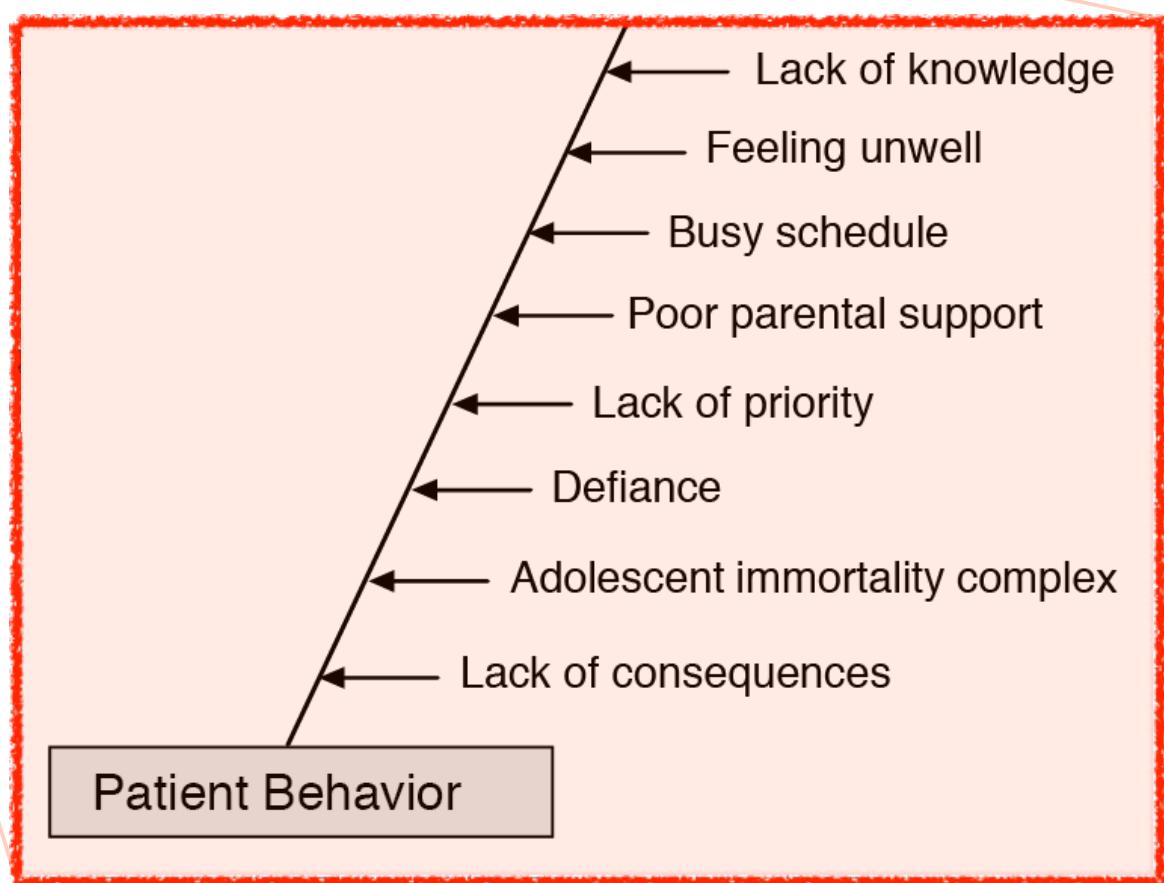
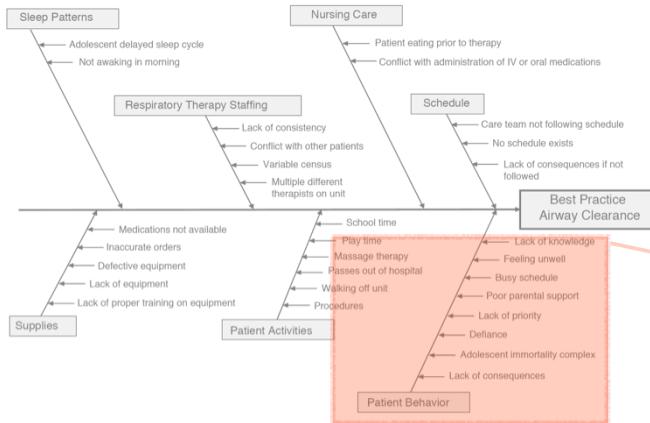
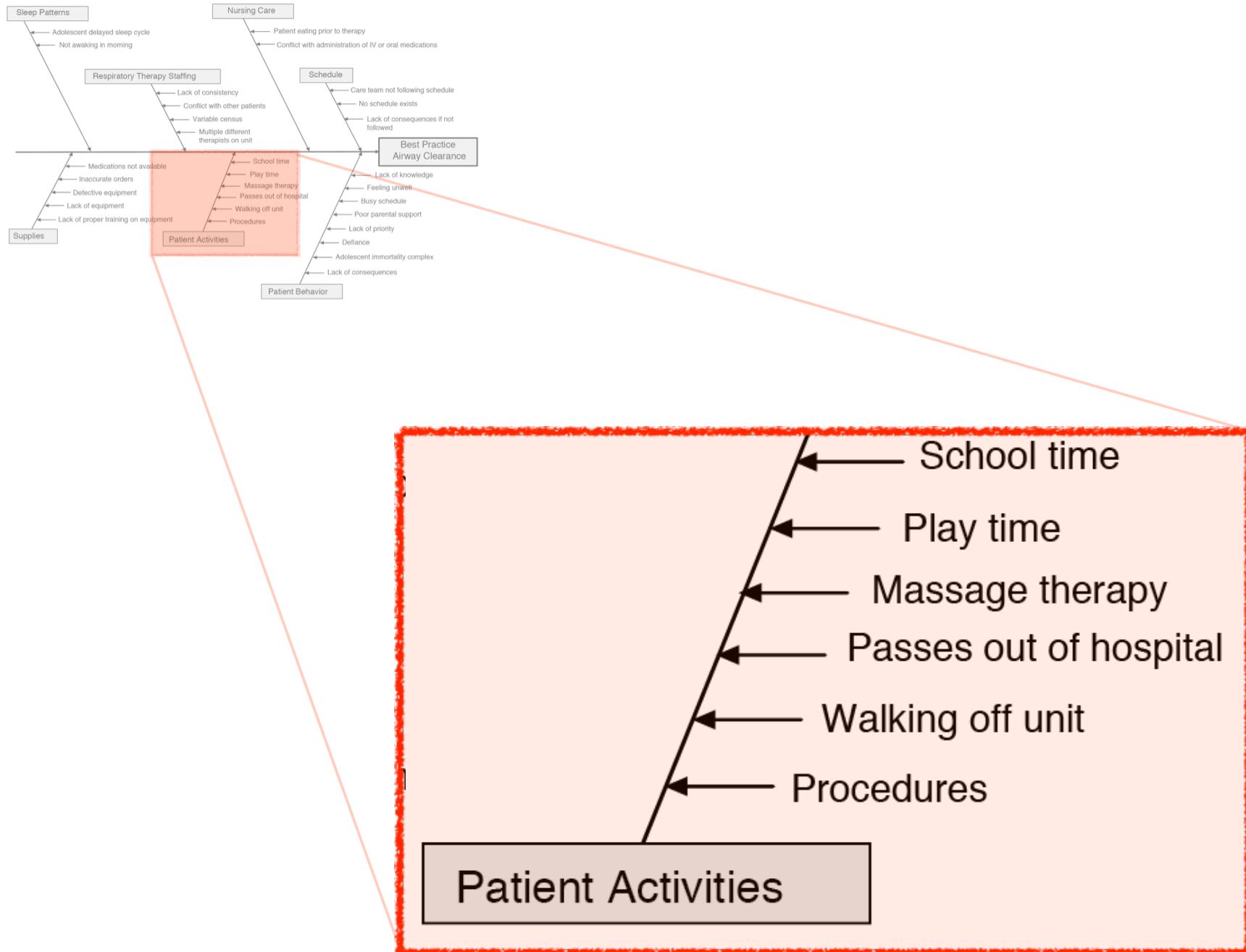


Figure 1. Fishbone diagram reflecting the team-identified 30 barriers to best practice ACT organized into key drivers.

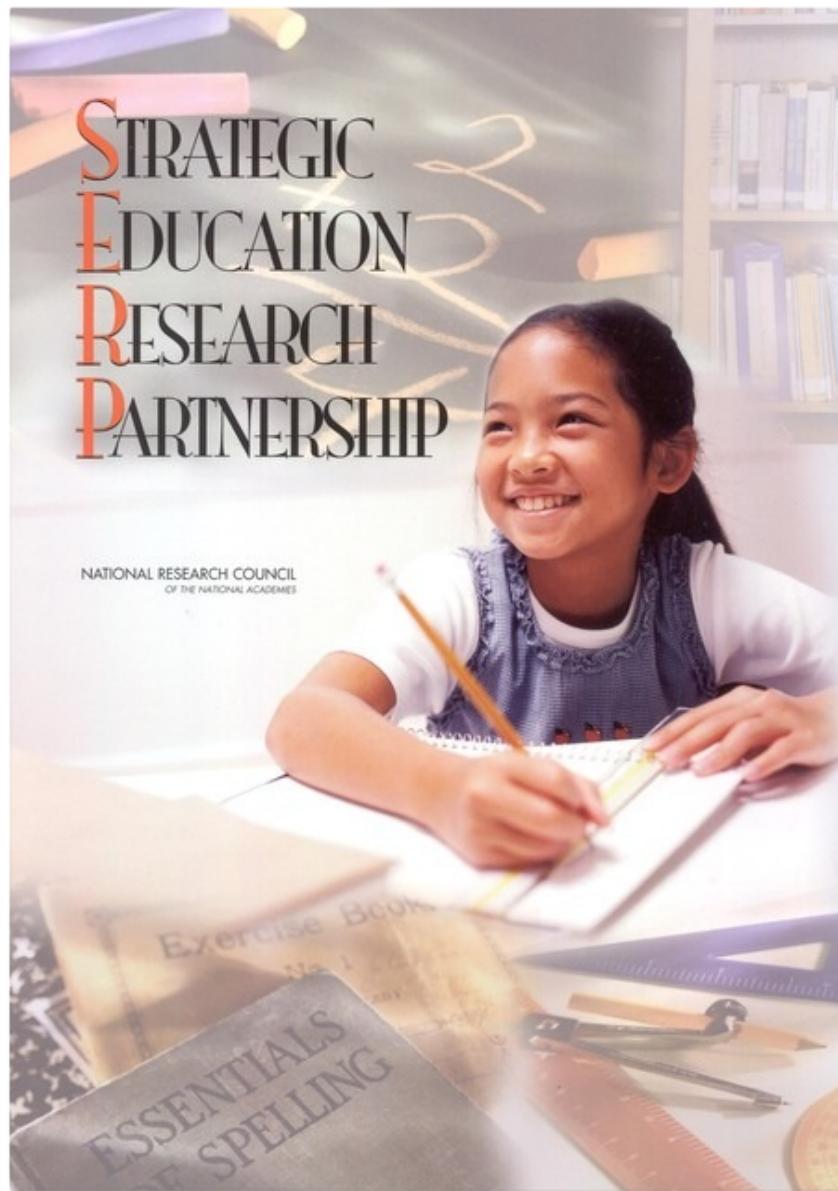




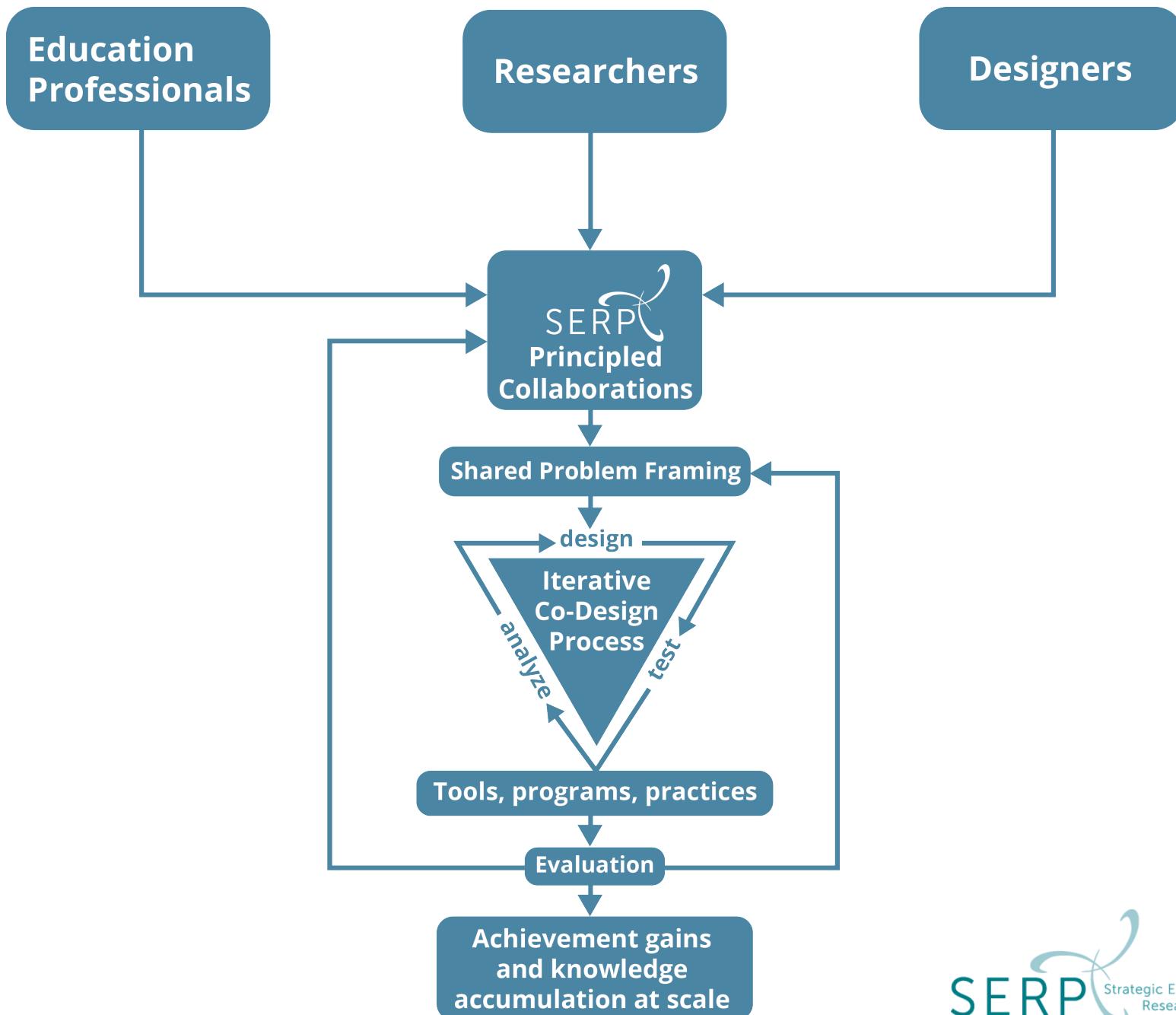


STRATEGIC EDUCATION RESEARCH PARTNERSHIP

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES









What's it look like?

STEM:

A dragonfly can fly fast. It can go about 50 feet in two seconds.

QUESTION:

How long would it take for the dragonfly to go 275 feet?

SOLUTION:

50 feet/2 seconds indicates a unit rate of 25 feet per second.

$$275 \div 25 = 11$$

Therefore the dragonfly can fly 275 feet in 11 seconds.



STEM:

A dragonfly can fly fast. It can go about 50 feet in two seconds.

QUESTION:

How long would it take for the dragonfly to go 275 feet?

**SOLUTION:**

50 feet/2 seconds indicates a unit rate of 25 feet per second.

$$275 \div 25 = 11$$

Therefore the dragonfly can fly 275 feet in 11 seconds.

Tools for Sense-making in Mathematics



Stem/Question/Solution
Triangles

Using Multiple
Representations

Mathematical
(and not-so-mathematical)
Diagrams

Early Stage Pilots of
Diagnostic Lessons,
Plus Videos

Watch this approach with eighth graders!
Teacher Alison Oliver gave two students the equation
 $x + .5y = 50$ to BEGIN their work in this lesson...

STEM:

QUESTION:

SOLUTION:

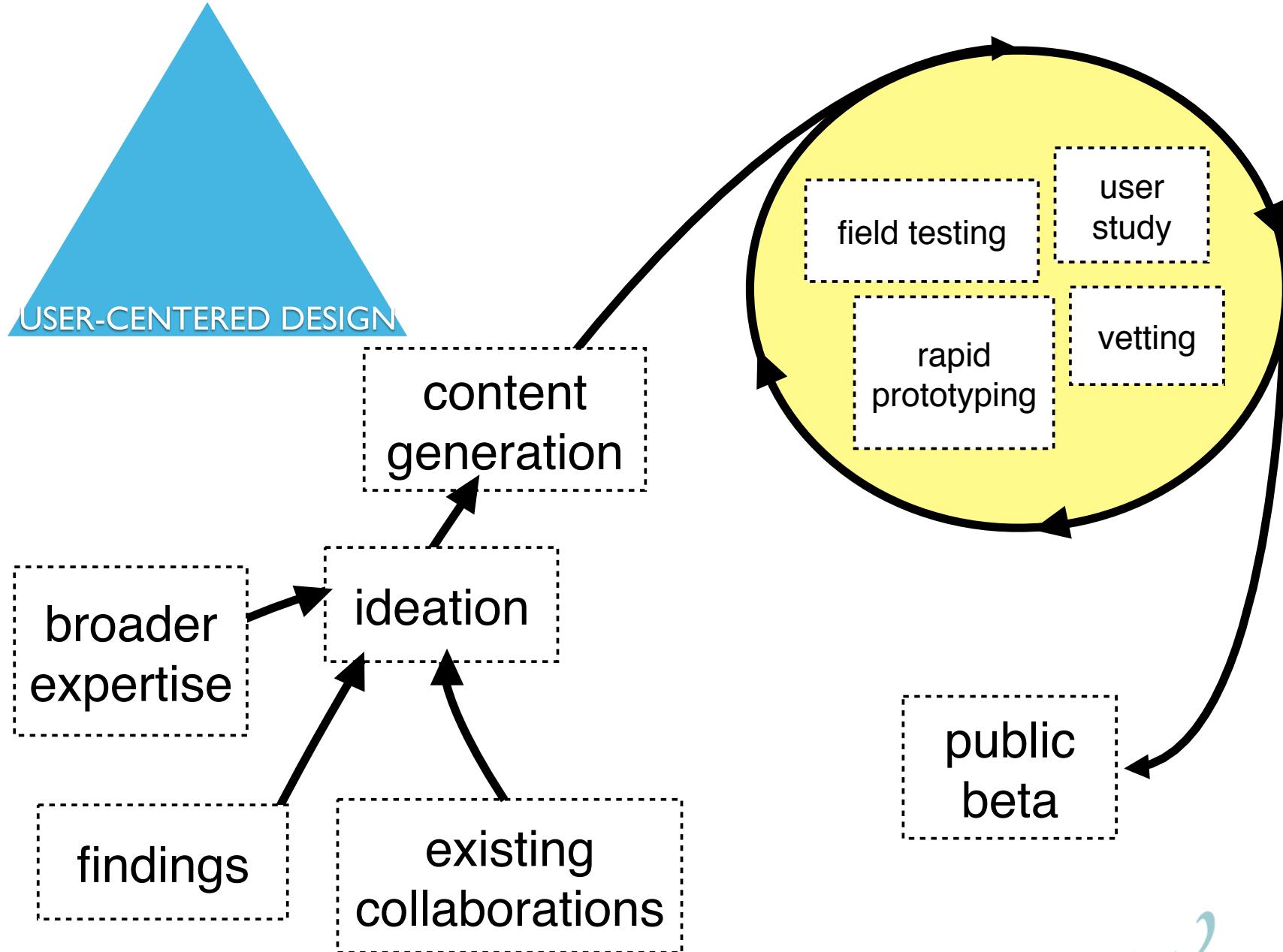
$x + .5y = 50$



About SERP

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Diagnostic Teaching in Mathematics



POSTER PROBLEMS

Home Teaching Poster Problems Curriculum Teacher Tune-ups

What is diagnostic teaching?

Teaching approach that aims to:

Common Core State Standards for Mathematics:

7.RP - 1, 2a, 2b, 2c, 2d

Teacher Tune Up:

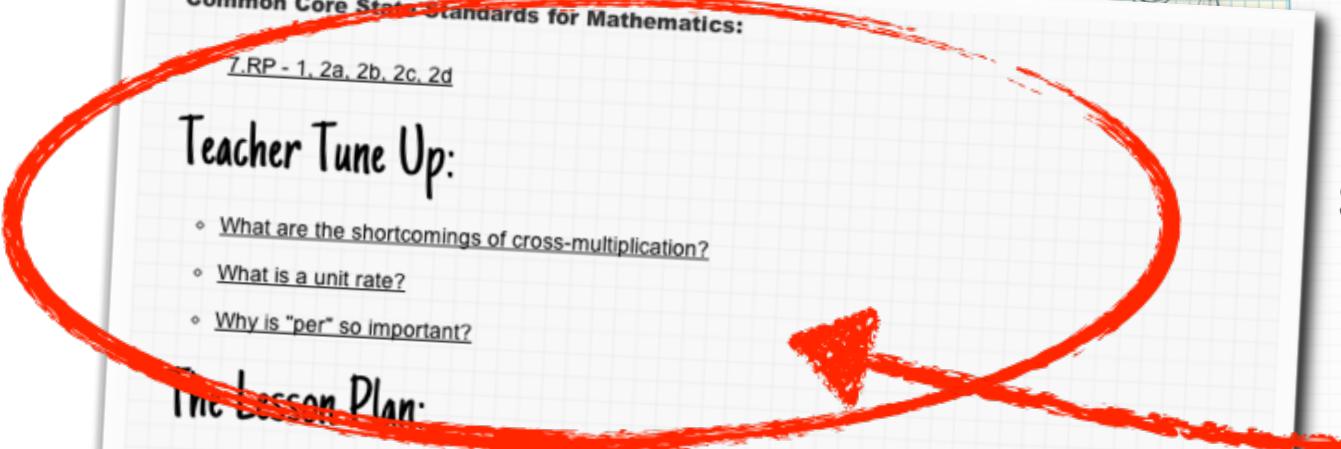
- What are the shortcomings of cross-multiplication?
- What is a unit rate?
- Why is "per" so important?

The Lesson Plan:

I. Launch

Ask students if they have ever seen a dragonfly. Ask them to describe one to their classmates.

Show **Slide #1** for a close-up look at a dragonfly.



Sixth Grade Problems

- The Intensity of Chocolate Milk
- No Matter How You Slice It
- Toothpick Patterns
- Rating Rate Plans
- Knowing Nets
- Roving Ranges

Seventh Grade Problems

- Drag Racer Dragonfly
- Seeing Sums
- Walking the Line
- On the Download
- Triangles to Order
- Try, Try Again



Project funding provided by:

THE WILLIAM AND FLORA HEWLETT FOUNDATION

Foundational work for this project by the SERP-SFUSD partnership was funded by the SD Bechtel Jr. Foundation.

Looking for Standards in the Mathematics Classroom

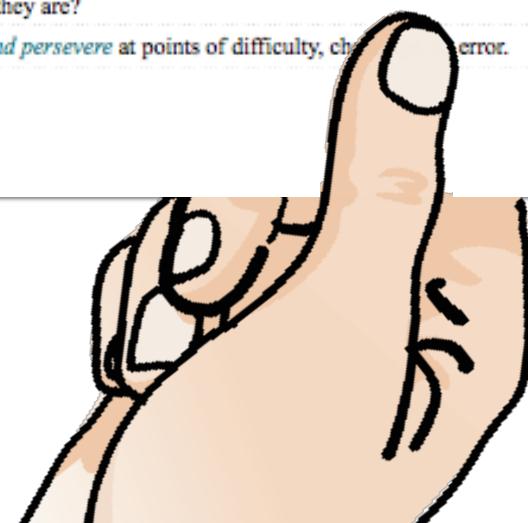
The Common Core State Standards (CCSS) define eight standards for students' Mathematical Practice. Not all standards will be evident every time, in every activity. You will find evidence of the standards that students are applying in the work and the talk of students. (see reverse)

CCSS Standard	Principle	Student Vital Action	SAC Evidence Gathering Card
The Standards for			
1. Make sense of problems and persevere in solving them	Logic connects sentences	Students <i>say a second sentence</i> (spontaneously or prompted by the teacher or another student) to explain their thinking and connect it to their first sentence. Practices 1 2 3 6	
2. Reason abstractly and quantitatively	Reasoning develops when students develop viable arguments	Students <i>talk about each other's thinking</i> (not just their own). Practices 1 2 3 6 7 8	
3. Construct viable arguments and critique the reasoning of others	Academic success depends on academic language	Students use general and discipline-specific <i>academic language</i> in their oral and written explanations and discussions (spontaneously and/or prompted by the teacher or other students). Practices 3 6	
4. Model with mathematics	Equity	<i>Which students are participating?</i> (e.g. boys more than girls, the same few students, ELL and special ed students?) Are they volunteering? Called on to do math? Talking about math in their group? Off task? All students ask math questions.	
5. Use appropriate tools strategically	ELLs develop language through content	<i>English learners produce language</i> that communicates ideas and reasoning, even when that language is imperfect. They take advantage of available language supports and resources: peer support, sentence frames, multiple choice oral responses, visual representation, graphic organizers, home language, cognates, etc. Practices 1 2 3 6	
6. Attend to precision	Students write explanations	Students revise their thinking, and their written work includes <i>revised explanations</i> and justifications. Practices 1 2 3 4	
7. Look for and make use of structure	A growth mindset matters	<i>Do students believe that they can learn to be good at math</i> by learning more math, by working hard, and by persevering to make sense of problems? Or do students think they cannot change how good at math they are?	
8. Look for and express regularity in repeated reasoning	Productive struggle, persistence	Students <i>engage and persevere</i> at points of difficulty, changing their thinking and strategy when they make an error.	



OAKLAND UNIFIED
SCHOOL DISTRICT

Community Schools, Thriving Students



Looking for Standards in the Mathematics Classroom

The Common Core State Standards (CCSS) define eight standards for students' Mathematical Practice. Not all standards will be evident every time, in every activity. You will find evidence of the standards that students are applying in the work and the talk of students.

Students should develop:

Principle

Student Vital Action

Logic connects sentences

Students *say a second sentence* (spontaneously or prompted by the teacher or another student) to explain their thinking and connect it to their first sentence.

Practices 1 | 2 | 3 | 6

Students *revise their thinking* and their written work includes *revived explanations and justifications*. Practices 1, 2, 3, 4

Do students believe that they can learn to be good at math by learning more math, by working hard, and by persevering to make sense of problems? Or do students think they cannot change how good at math they are?

Students engage and persevere at points of difficulty, challenge, or error.



AlgebraByExample
40+ Assignments with Worked Examples

Poster Problems
2-Day Lessons for Diagnostic Teaching

The Sx8 Card
Observation Tool for Developing CCSS Math Practices

Sense-making Tools
for Mathematics developed by SF. Math Teachers

math.serpmmedia.org

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AlgebraByExample

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Home The Format Using these materials The R&D What teachers are saying

Math teachers know that some mathematical mistakes are made over and over again. Research suggests these kind of repeated errors are often due to students' underlying misconceptions.

Teachers and researchers worked in partnership to create AlgebraByExample assignments that

1. target students' misconceptions
2. affective errors (emotional errors)
3. errors by many different students and learning styles
4. align with the Common Core Practice Standards
5. promote teachers' knowledge and mathematical discussions

Helps students:

- Identify, discuss, and reduce misconceptions
- Deepen correct conceptual understanding
- Encourage procedural skills

Provides teachers:

- Insights into student thinking
- Launch point for mathematically rich discussion
- Shared language for analyzing mistakes



The SERP-MAN partnership has been supported to conduct this work by The Gordon-Sanjour Foundation, the San Francisco Unified School District, and the San Francisco Unified School District's Office of Mathematics, through grant #2024100103 to Strategic Education Research Partnership Institute.

[Printable one-page description](#)



Tools for Sense-making in Mathematics



About SERP's work with San Francisco Math Teachers

This website is the product of a SERP collaboration with middle school mathematics teachers in the San Francisco Unified School District. Over the course of several years, SERP worked with a group of teachers to develop a set of tools to support the CCSS Standards in Mathematics. Professor Alan Schoenfeld (UC Berkeley) and a team of researchers conducted a series of studies to understand what teachers and students were struggling with math in the middle grades, and what they could do to support student learning. We began with data that indicated students did not struggle with particular math topics, but rather with particular problem types: word problems.

Teachers conducted "think-alouds" with students, and found that many students began to struggle with word problems when they were asked to interpret the question being asked. They looked for signals that would indicate whether to subtract, multiply, or divide or some other operation. The question in our group was how could we support the shift in the way teachers and students approached word problems? We are not suggesting that getting answer-getting out of the way is good, but rather that we need to support sense-making.

We set out to identify relatively small changes that could create relatively big shifts in behavior and expanded to include fully designed diagnostic lessons. We hope others will use these strategies of value. If you try these out in your classroom, please let us know what you think by sending your comments to [info@serpinstitute.org](#)



[Meet the team!](#) [About SERP](#) [More SERP math stuff](#) [SERP's Public Products](#)

[View/Download the Sx8 Card](#) [The CCSS Mathematical Practices](#)

The Sx8 Card

The "Sx8 Card" was generated by a SERP team working in collaboration with math leaders in San Francisco and Oakland Unified School Districts. Leaders in both districts were aware that the fundamental nature of the shifts demanded by the CCSS-M Practice Standards requires considerable learning on the part of teachers and students. They were also aware, however, that the change must be led by the school principal.

The Sx8 Card is a product of a user-centered design process in which the user was the school principal. The focus of the process was to develop student expertise in mathematical practices defined in the CCSS Mathematical Practice Standards 1 through 8. Extended interaction of SERP's math team with school principals regarding their leadership of the shift to the CCSS-M Practices Standards informed the design process through which the expressed needs and dispositions of principals influenced the set of design specifications:

- Minimize reading.** Principals insisted that they have minimal time to spend reading the card in order to make their way through pages of material. The card is named after the user, the school principal, and the user is the one who proceeds with useful guidance that would fit on a 8x8 card.
- Use concrete, catalytic ideas** that are relevant across subjects and across responsibilities and expertise. Principals find efforts to be comprehensive burdensome, and they are more inclined to take on responsibilities and expertise that offer value in ways that the school principal rather than stimulate action.
- Aim for a level of specificity** regarding the practices that is relevant across subjects and across responsibilities and expertise. Principals acknowledge their role as instructional leaders. But they are also leaders of their school, highly expert in all content areas, and are more inclined to take action on the expertise they assume.
- Focus attention on student actions rather than teacher actions.** The CCSS-M practices target specific actions expected of students. Principals have different ways to support student actions. It is student actions that lead to learning. Principals are more inclined to take action on the expertise they assume.

[read more ▶](#)

 **Phil Daro on the Sx8 Card** and the Common Core State Standards

 **Components of the Sx8 Card and Teacher Moves**

 **other SERP math stuff**

The problem-solving
partnership approach
treats teachers as
essential members of
the team & as clients

For teachers: To achieve a high functioning K-12 education system, what portion of the challenge can be addressed through site-based problem-solving partnerships (research, practice, design)?

 Text a **CODE** to 22333

0 **430424**

1-25 **430430**

26-50 **430431**

51-75 **479746**

76-100 **480219**

[Results](#)

For non-teachers: To achieve a high functioning K-12 education system, what portion of the challenge can be addressed through site-based problem-solving partnerships (research, practice, design)?

 Text a **CODE** to 22333

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1-25	479909
26-50	479911
51-75	480220
76-100	480226

[Results](#)

