

# 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      | <b>390236</b> |
| 1–25   | <b>390239</b> |
| 26–50  | <b>390246</b> |
| 51–75  | <b>477655</b> |
| 76–100 | <b>478908</b> |

[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?

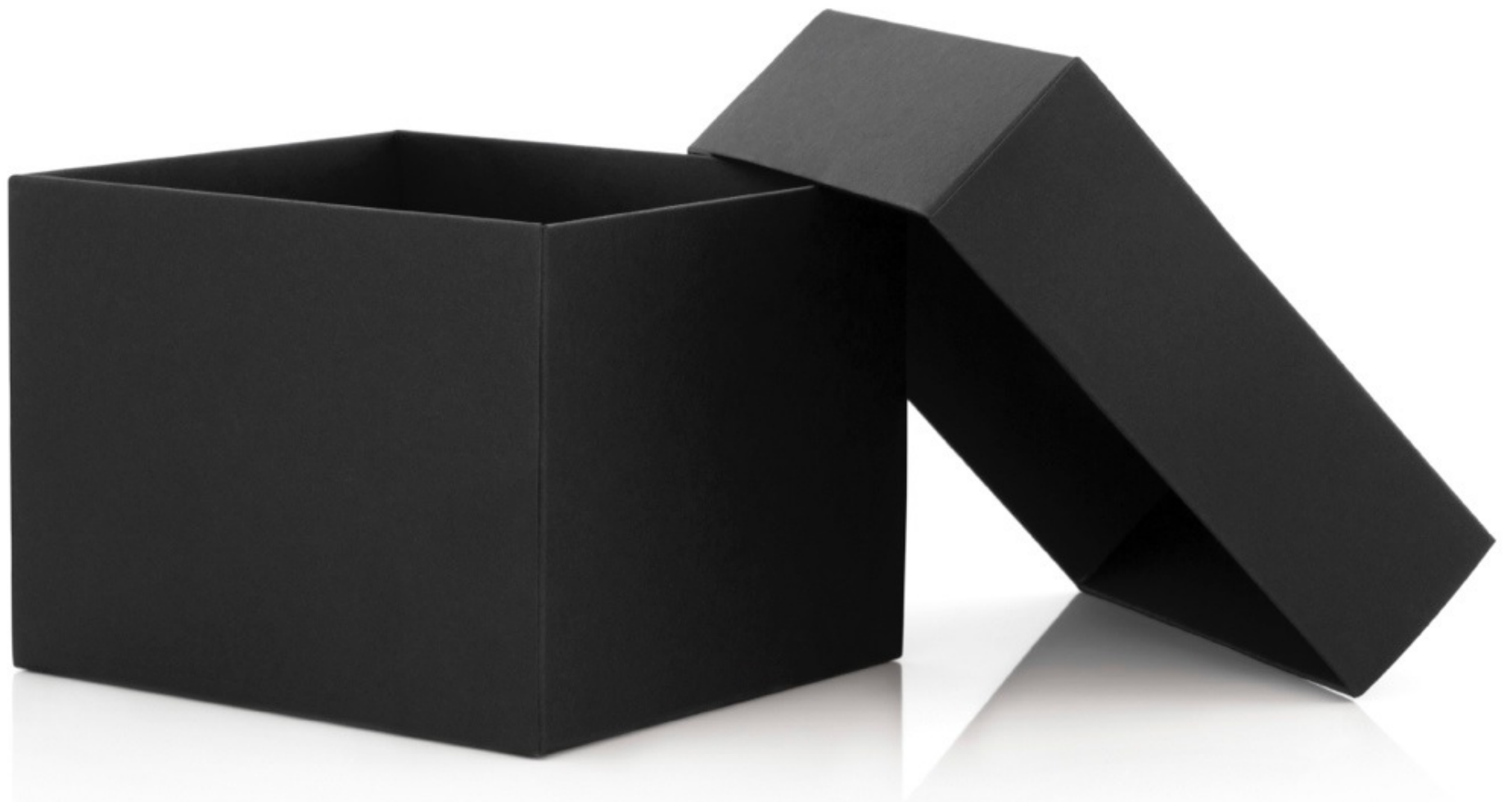
 Text a **CODE** to 22333

|        |               |
|--------|---------------|
| 0      | <b>478937</b> |
| 1-25   | <b>478939</b> |
| 26-50  | <b>478942</b> |
| 51-75  | <b>478943</b> |
| 76-100 | <b>478944</b> |

[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

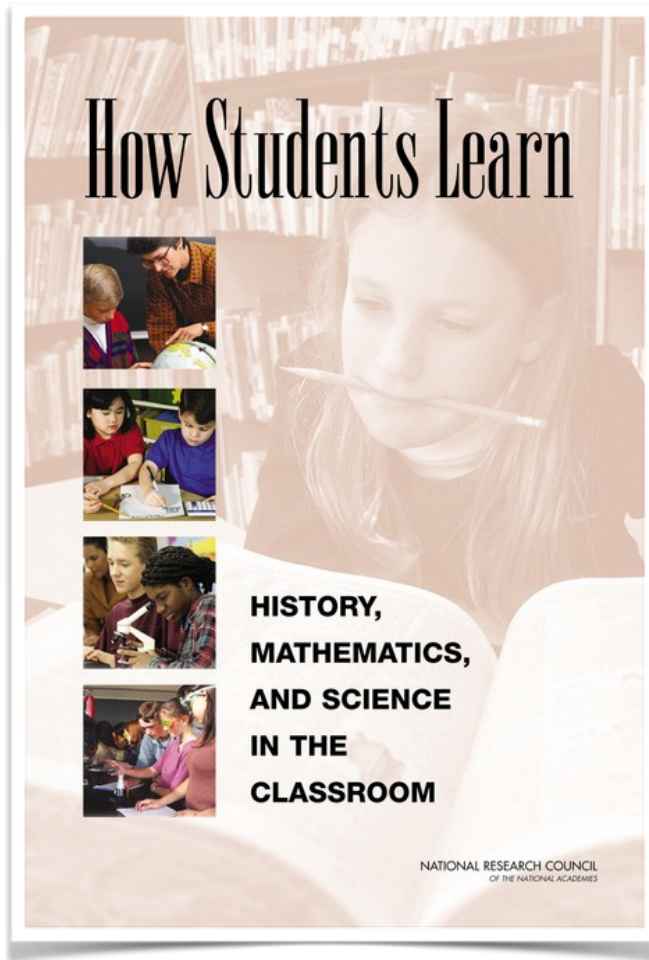
- Elicit and engage students' thinking so they can construct the targeted understanding
- Organize knowledge in a conceptual framework/  
link to big ideas
- Build metacognitive skills

# How People Learn

BRIDGING  
RESEARCH  
AND  
PRACTICE

NATIONAL RESEARCH COUNCIL





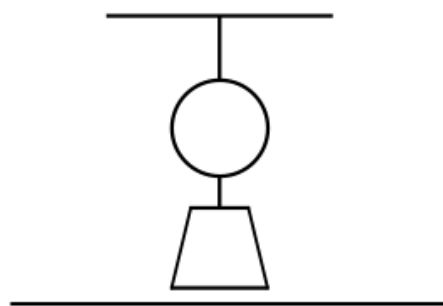
11

# Guided Inquiry in the Science Classroom

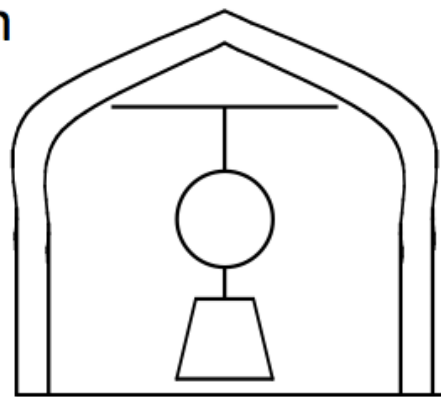
*James Minstrell and Pamela Kraus*

- 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

|   |               |
|---|---------------|
| 0 | <b>479793</b> |
|---|---------------|

|      |               |
|------|---------------|
| 1-25 | <b>479803</b> |
|------|---------------|

|       |               |
|-------|---------------|
| 26-50 | <b>479813</b> |
|-------|---------------|

|       |               |
|-------|---------------|
| 51-75 | <b>479814</b> |
|-------|---------------|

|        |               |
|--------|---------------|
| 76-100 | <b>479815</b> |
|--------|---------------|

[Results](#)

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

 Text a **CODE** to 22333

|   |               |
|---|---------------|
| 0 | <b>479786</b> |
|---|---------------|

|      |               |
|------|---------------|
| 1–25 | <b>479788</b> |
|------|---------------|

|       |               |
|-------|---------------|
| 26–50 | <b>479789</b> |
|-------|---------------|

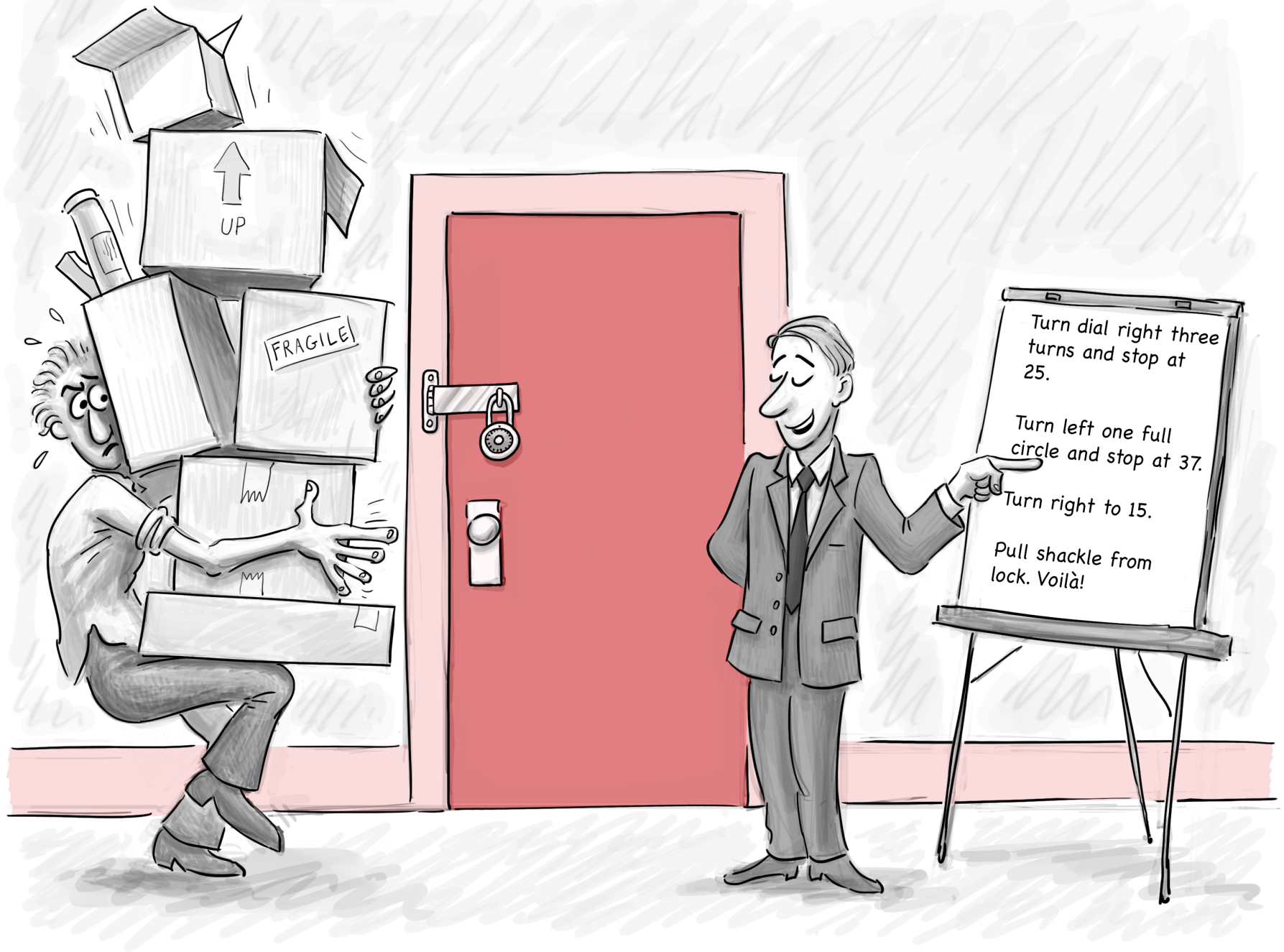
|       |               |
|-------|---------------|
| 51–75 | <b>479790</b> |
|-------|---------------|

|        |               |
|--------|---------------|
| 76–100 | <b>479791</b> |
|--------|---------------|

[Results](#)

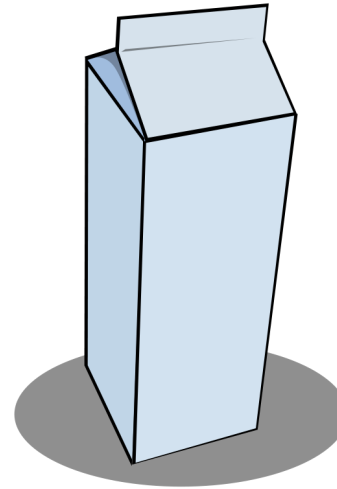
**Translational Research  
treats teachers as  
targets for learning**





# Lost in Translation

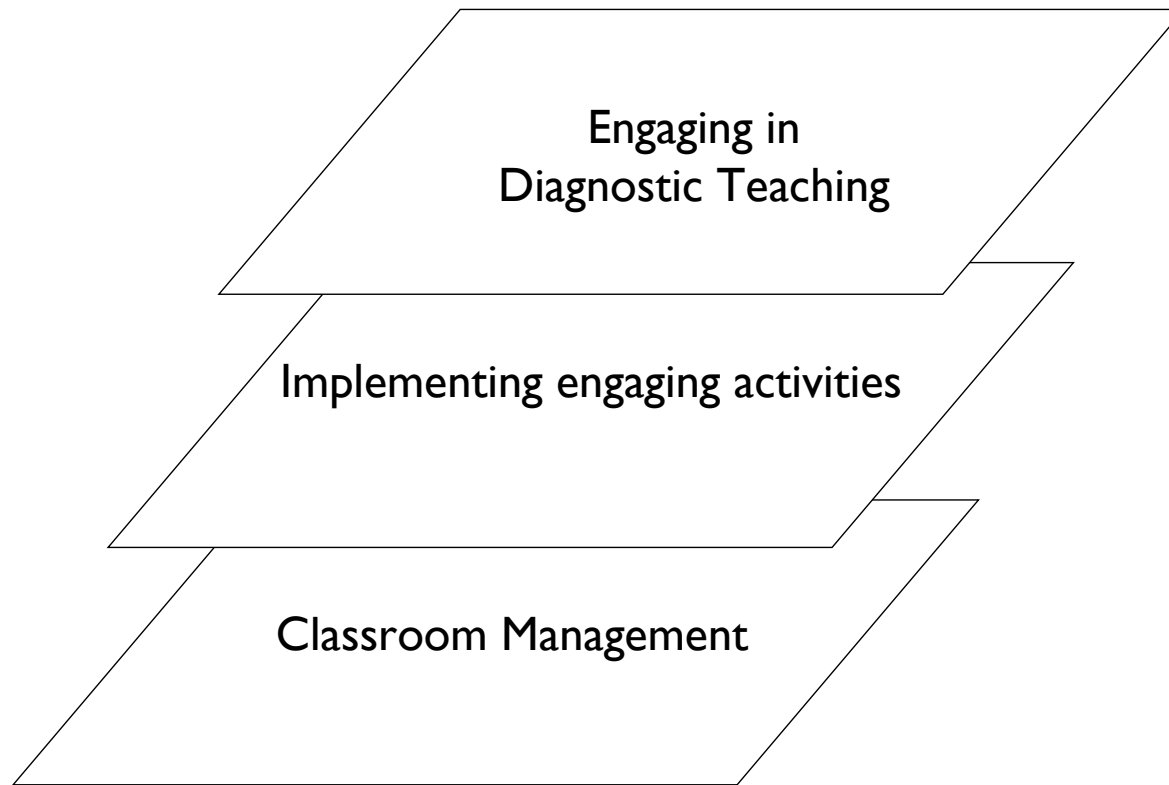
**Value for  
research  
knowledge**



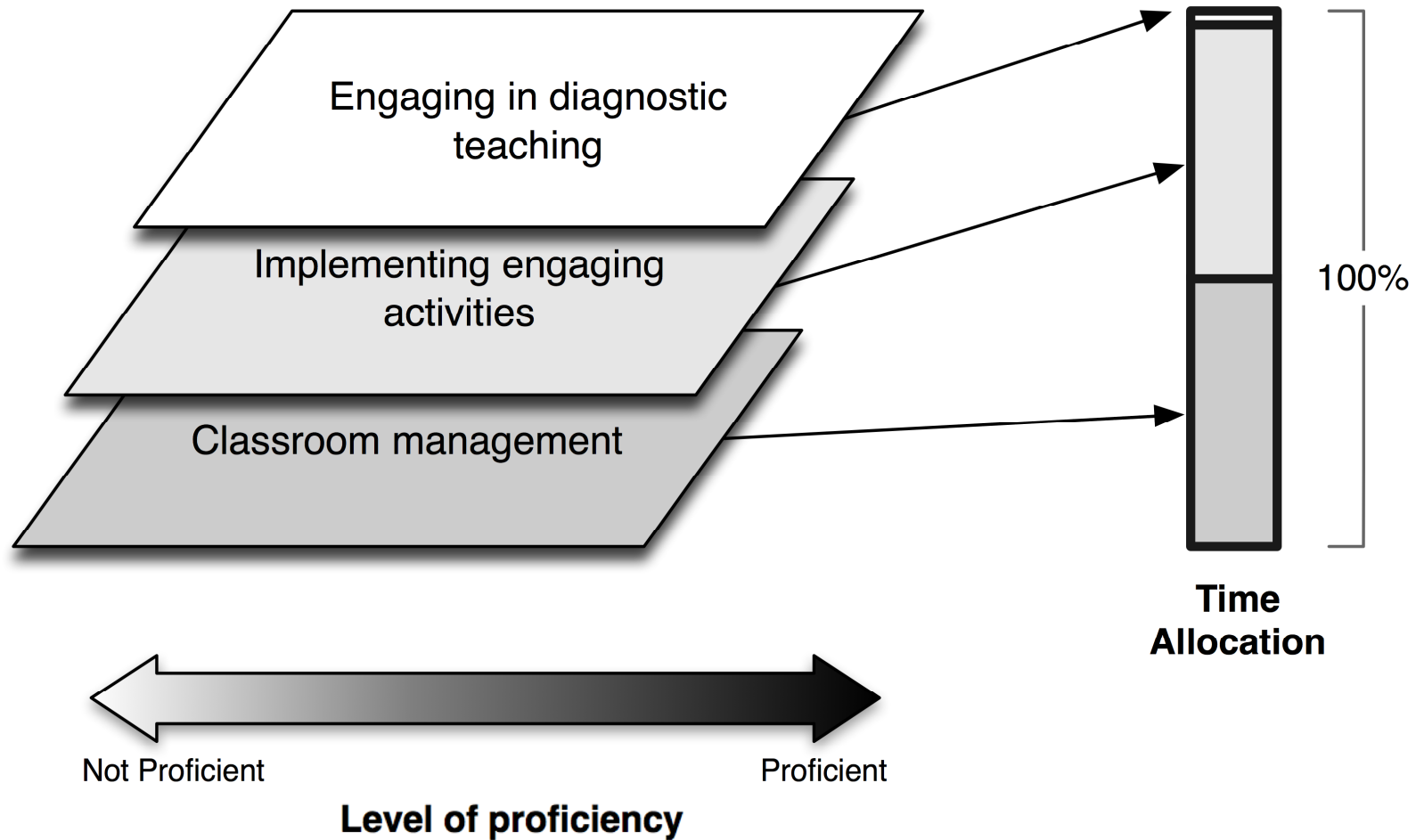
**Value for  
practical  
knowledge**

## Pasteur's Quadrant

# Alan Schoenfeld's Three Planes of Teaching Activity

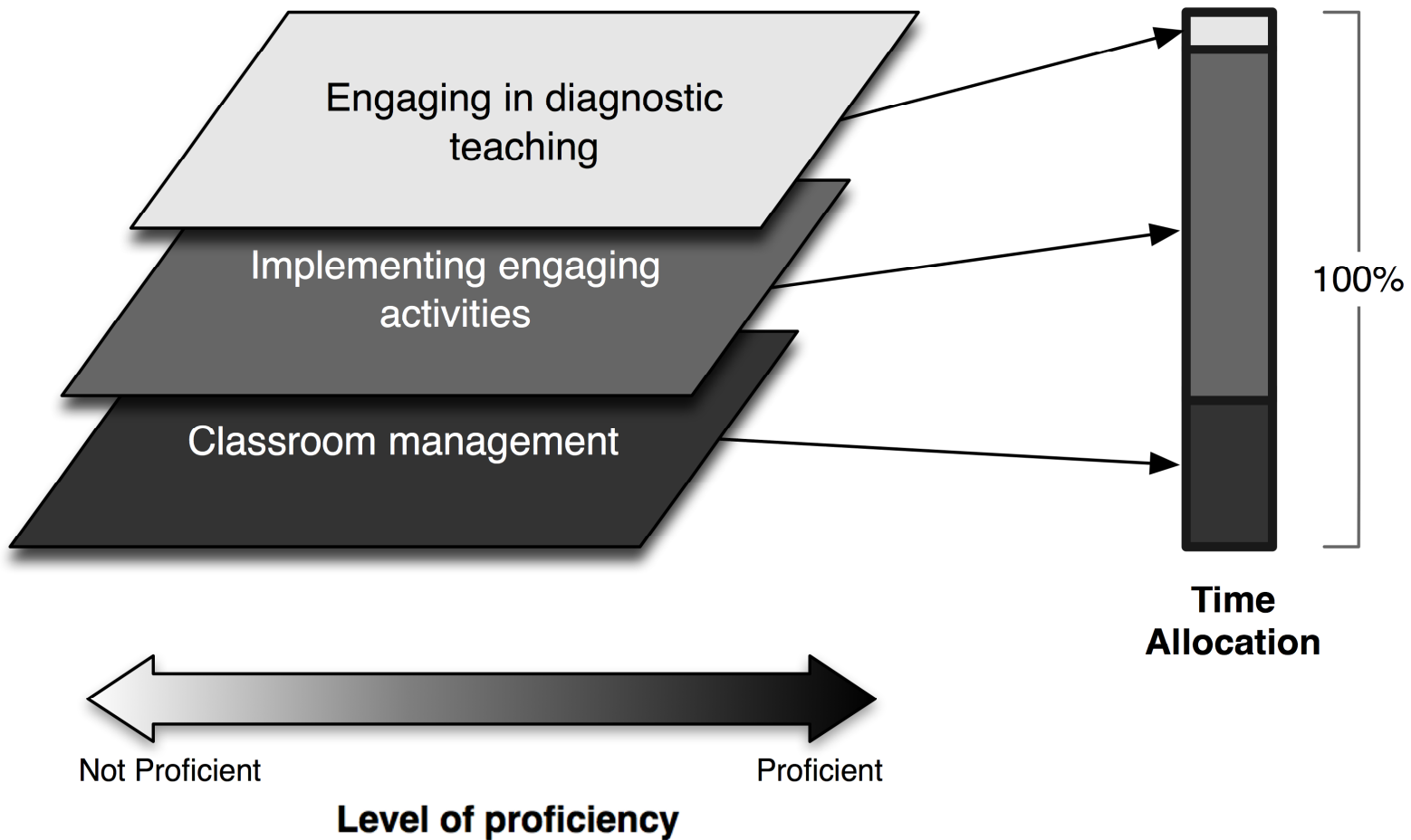


# A Typical Beginning Teacher Profile



Courtesy of Alan Schoenfeld

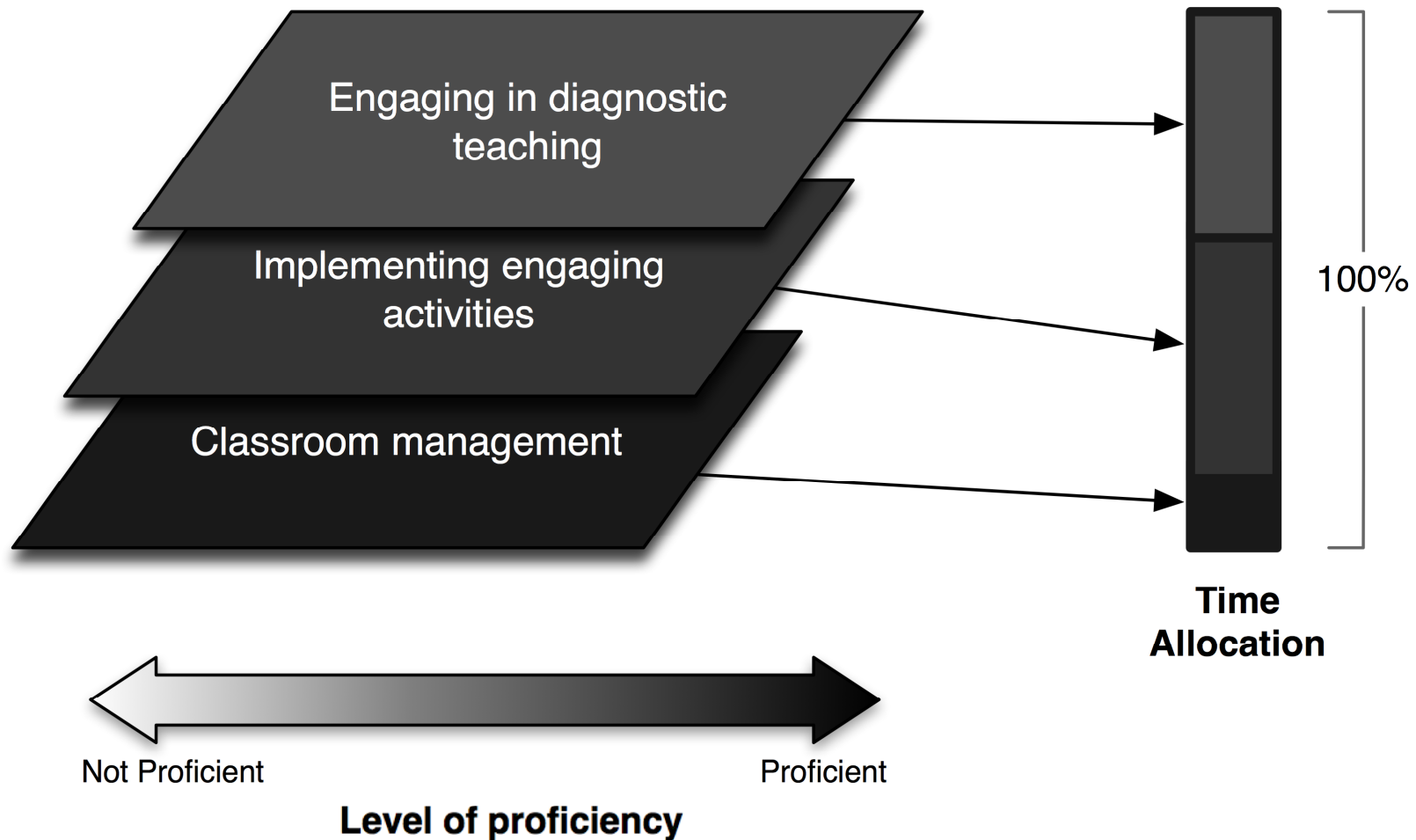
# A Typical Accomplished Teacher Profile



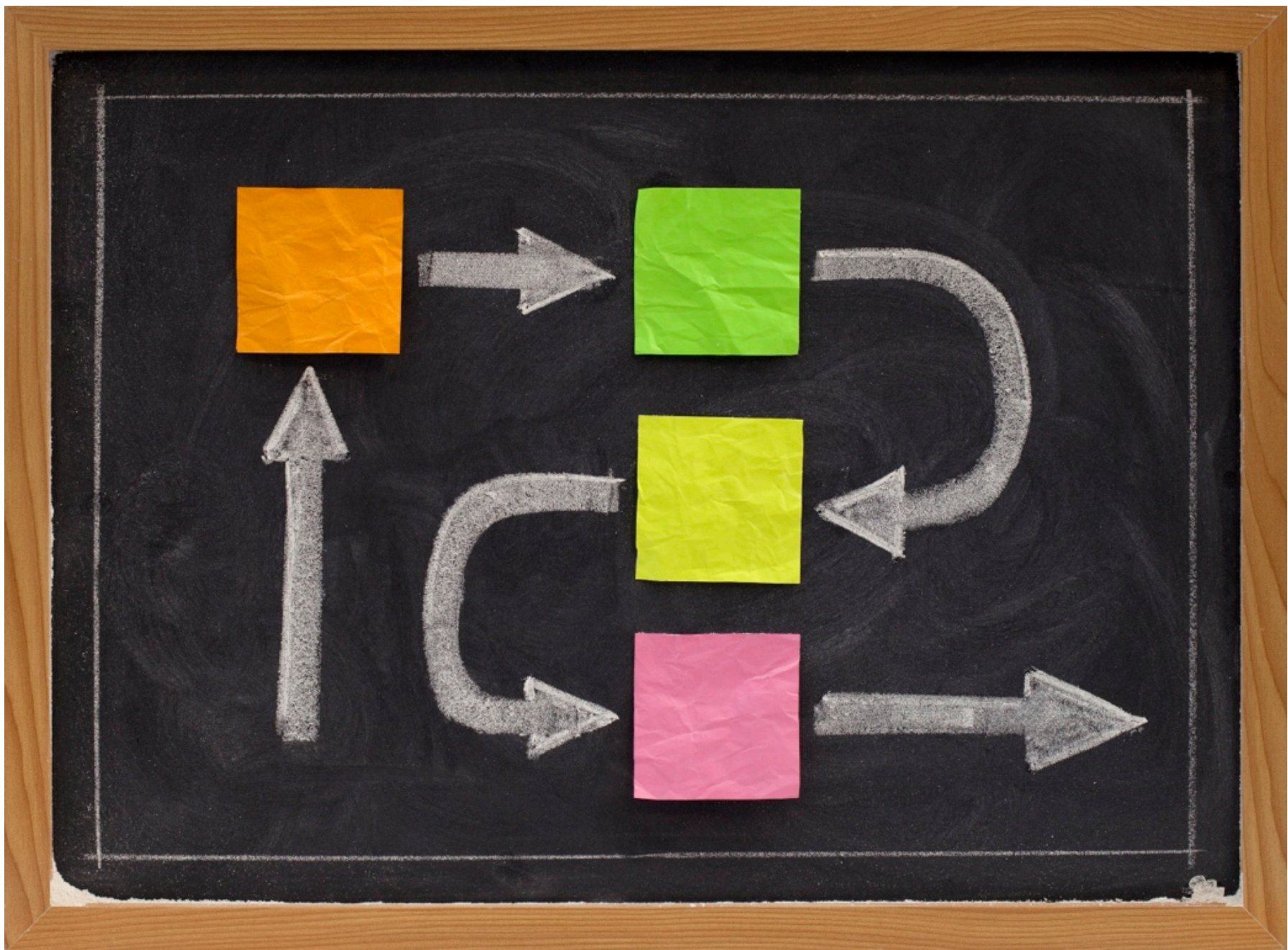
Courtesy of Alan Schoenfeld



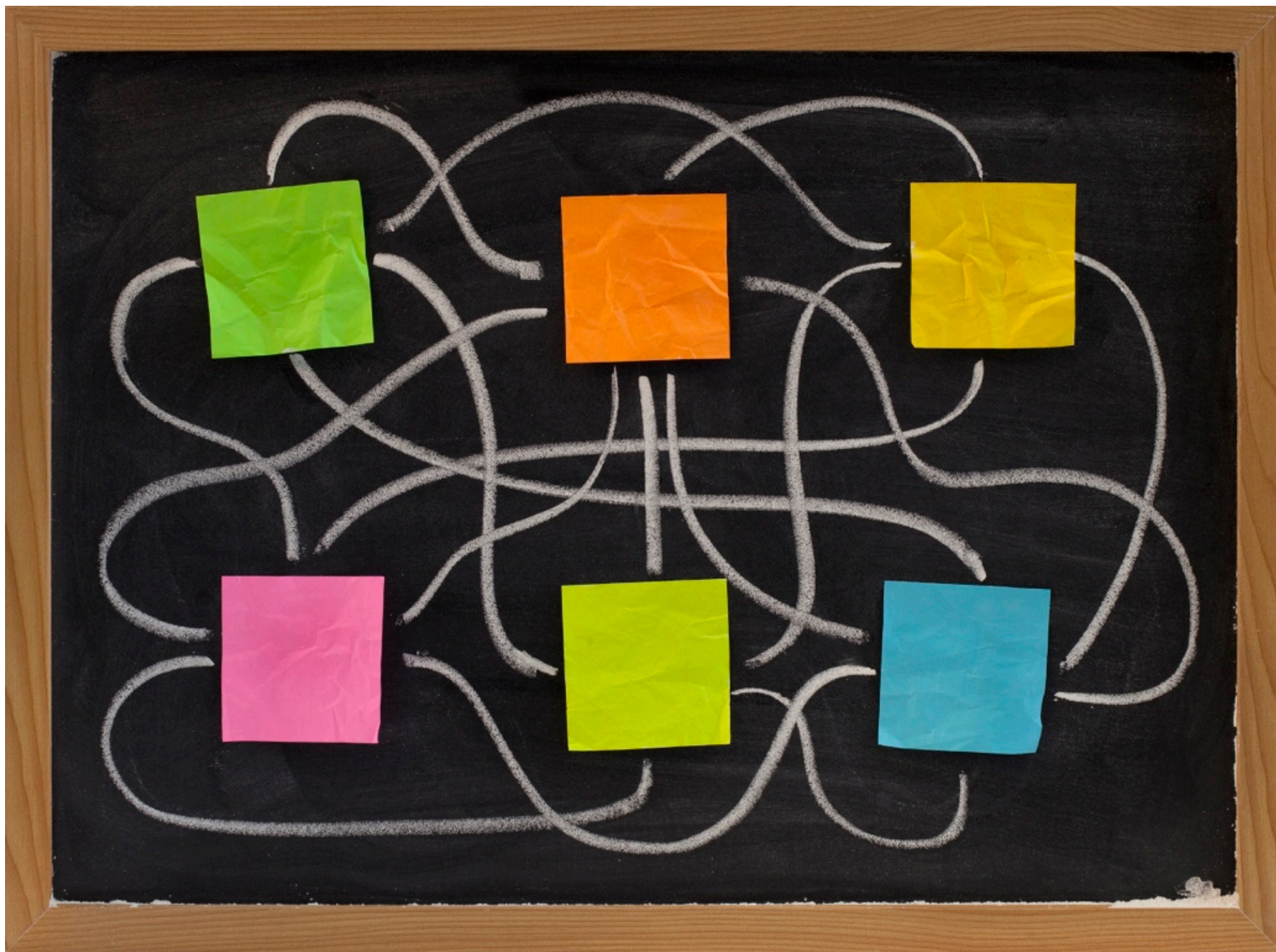
# A Typical Expert Teacher Profile



Courtesy of Alan Schoenfeld







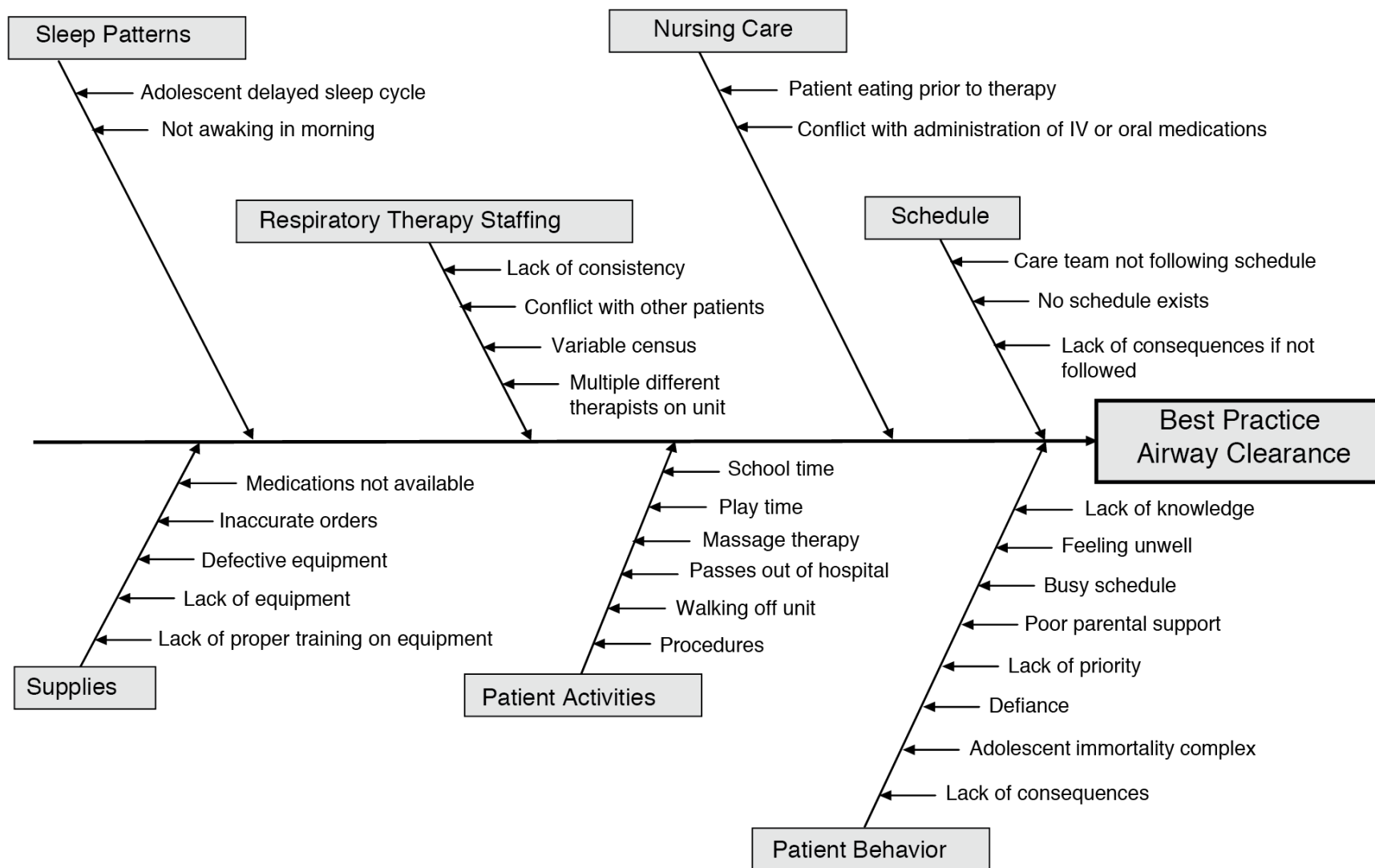
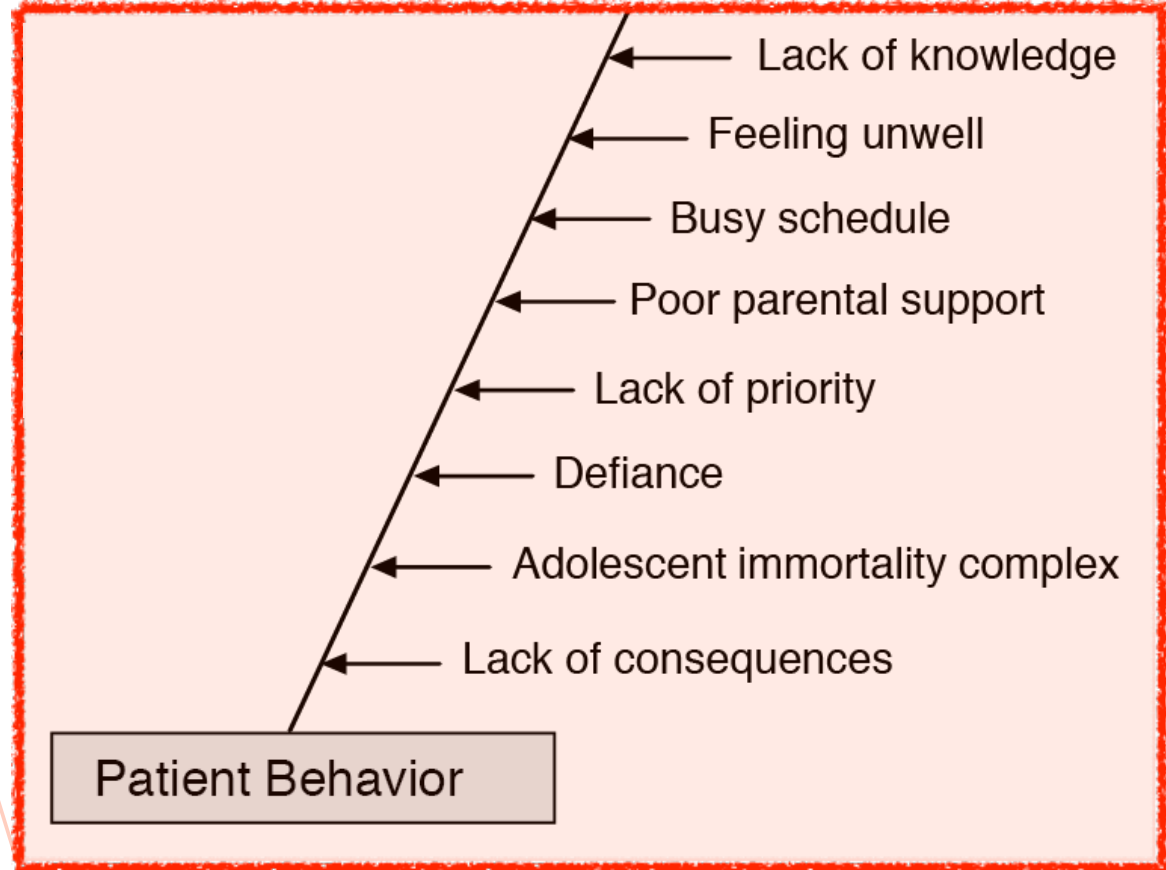
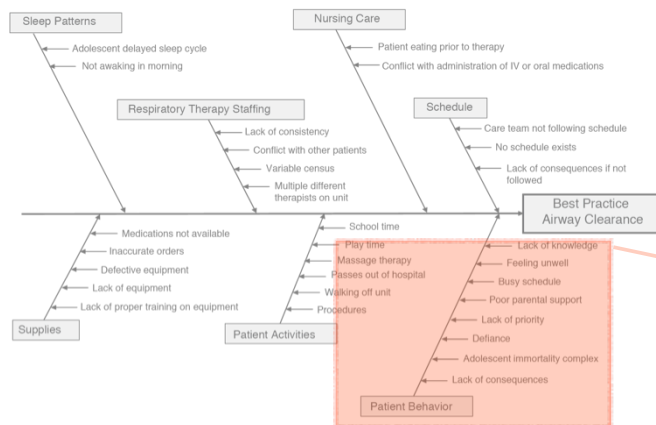
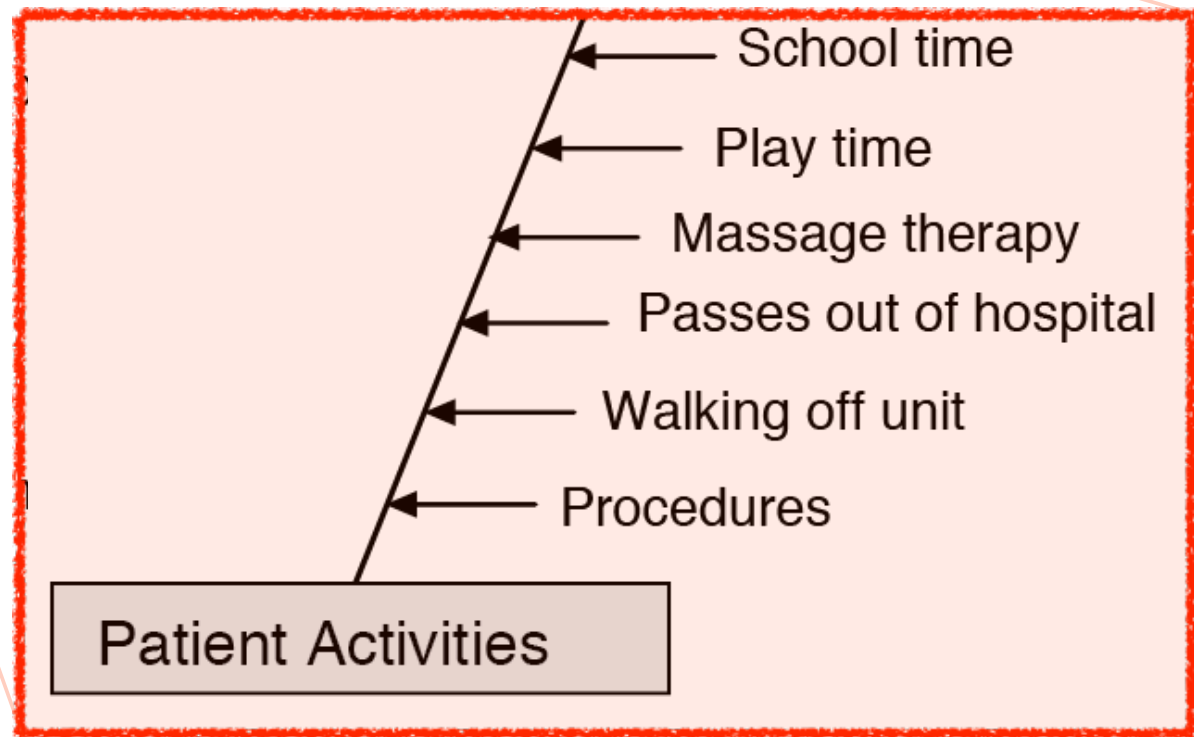
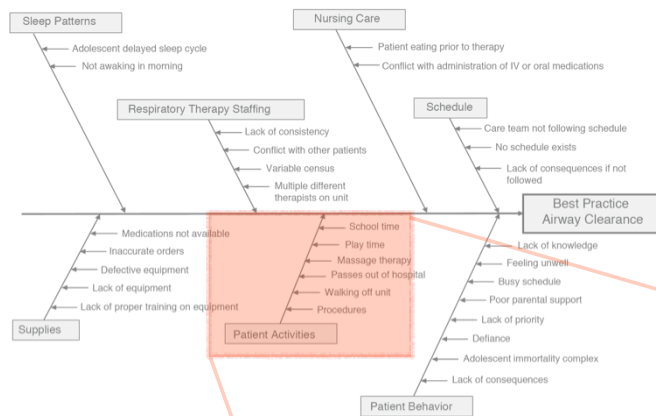


Figure 1. Fishbone diagram reflecting the team-identified 30 barriers to best practice ACT organized into key drivers.



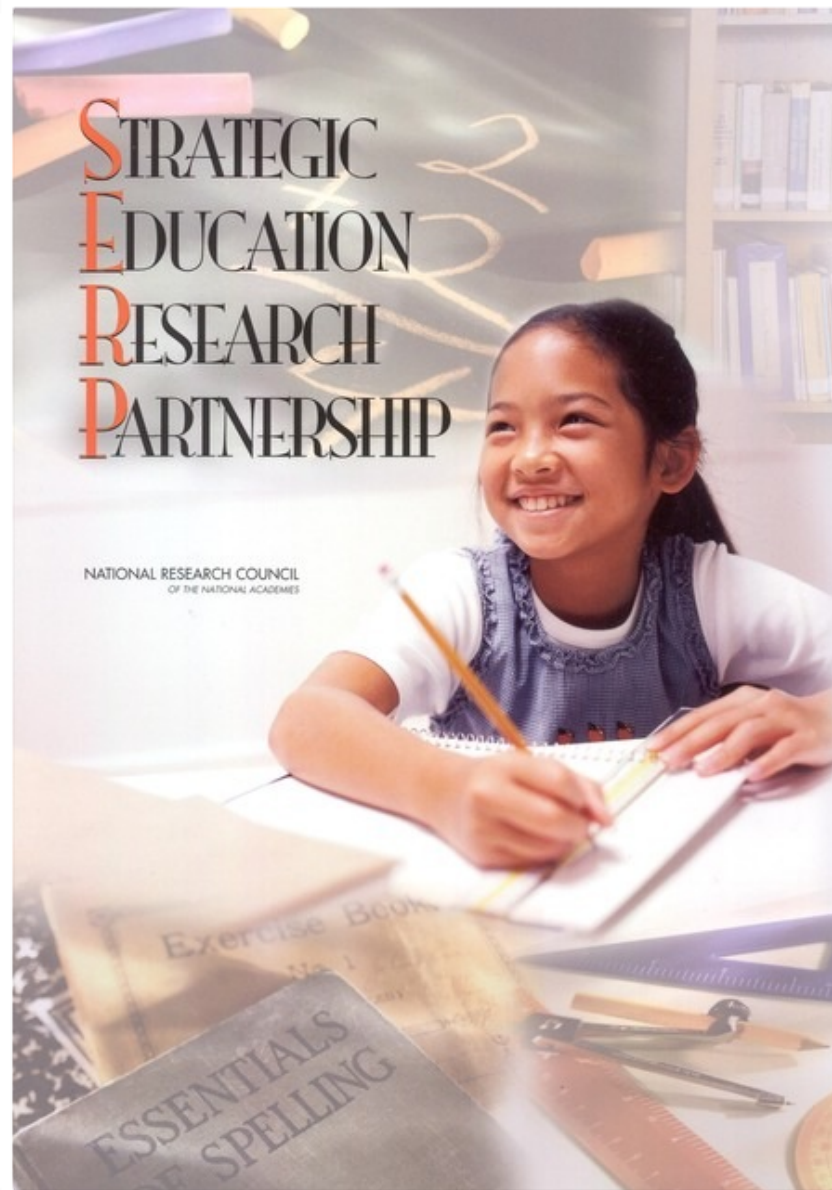




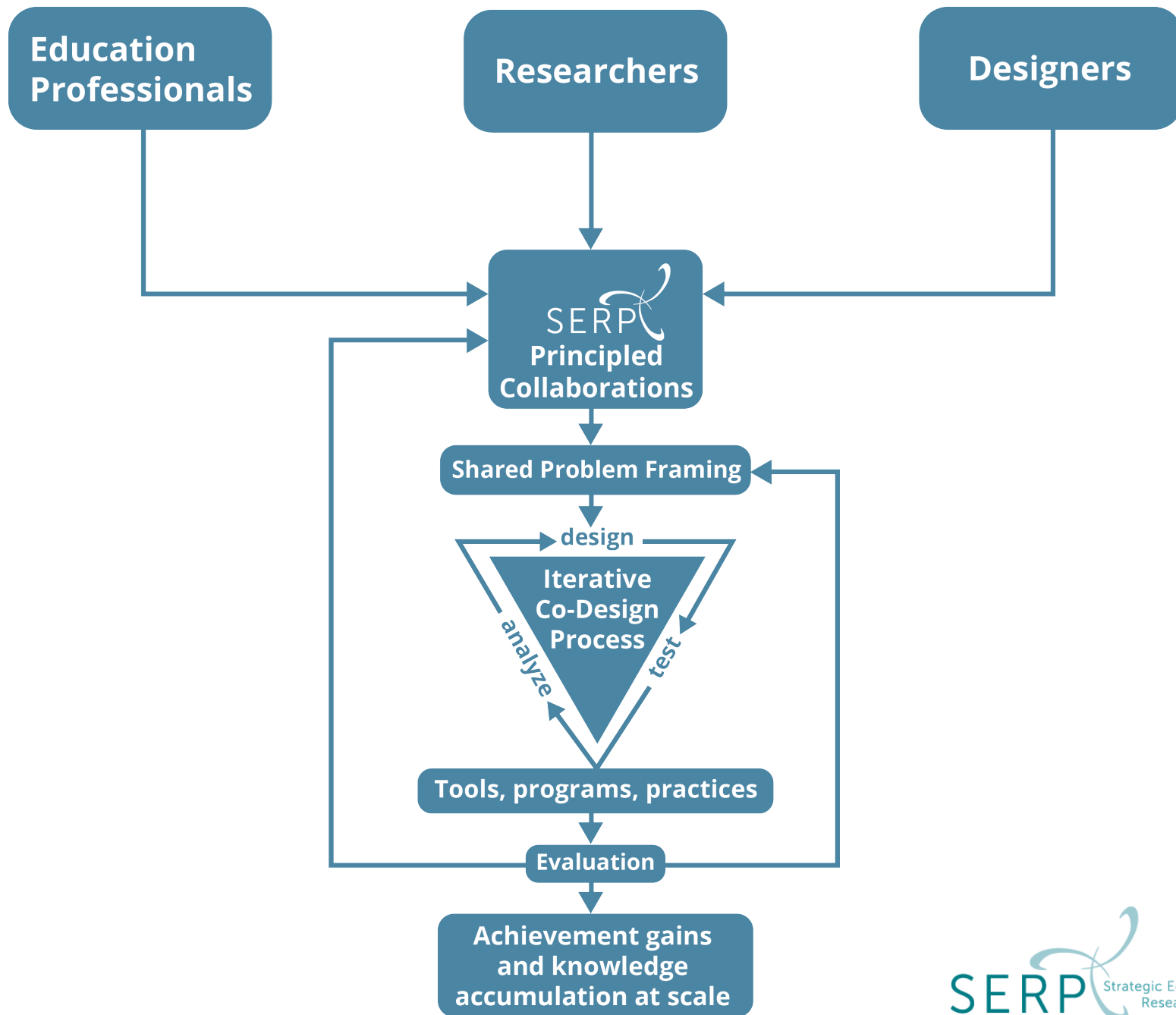


# STRATEGIC EDUCATION RESEARCH PARTNERSHIP

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:**

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**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

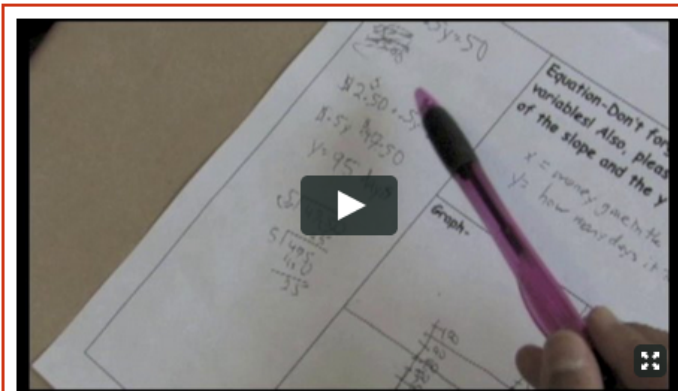
Watch this approach with eighth graders!  
Teacher Alison Oliver gave two students the equation  
 $x + .5y = 50$  to BEGIN their work in this lesson...

**STEM:**

**QUESTION:**

**SOLUTION:**

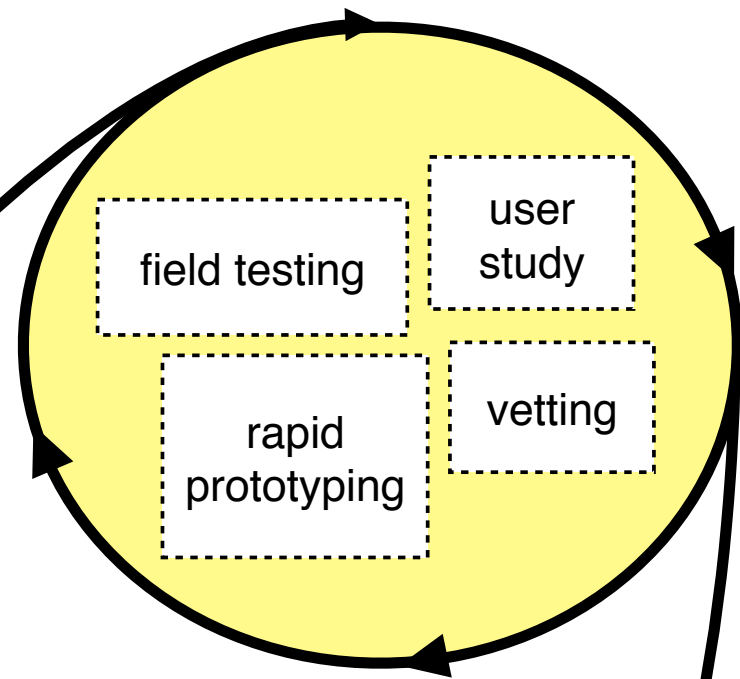
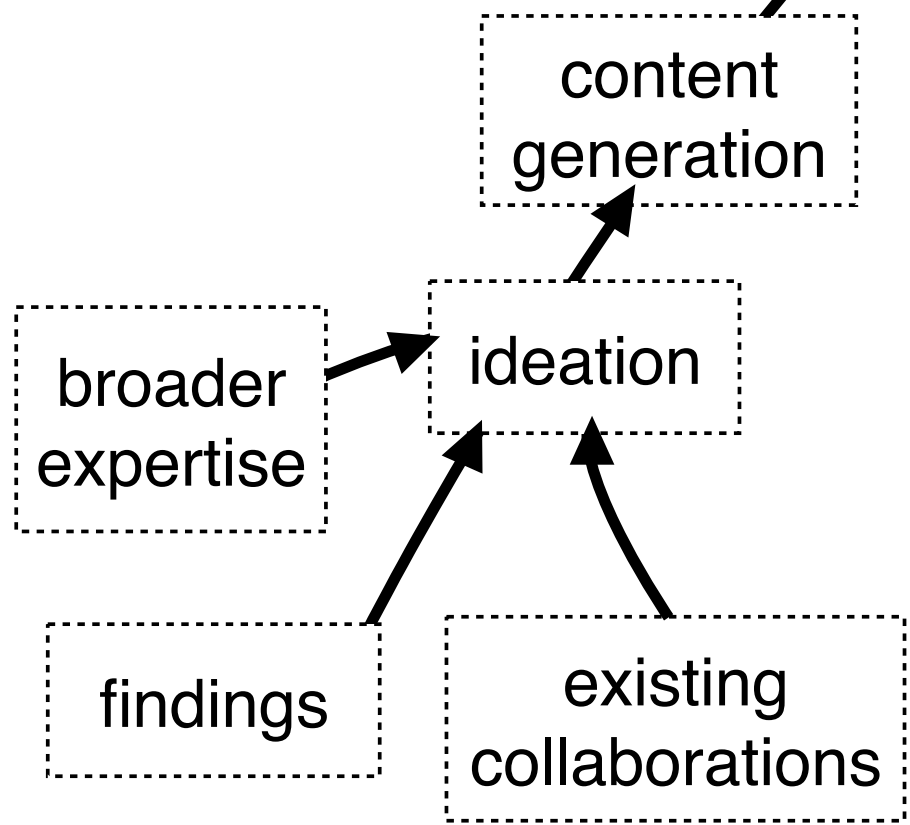
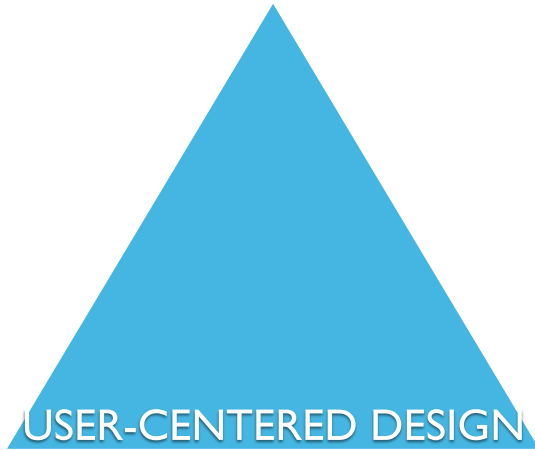
$$x + .5y = 50$$



About SERP

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Products





## Diagnostic Teaching in Mathematics



## POSTER PROBLEMS

Home

Teaching Poster Problems

Curriculum

Teacher Tune-ups

### What is diagnostic teaching?

Diagnostic teaching 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
- Roaming 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

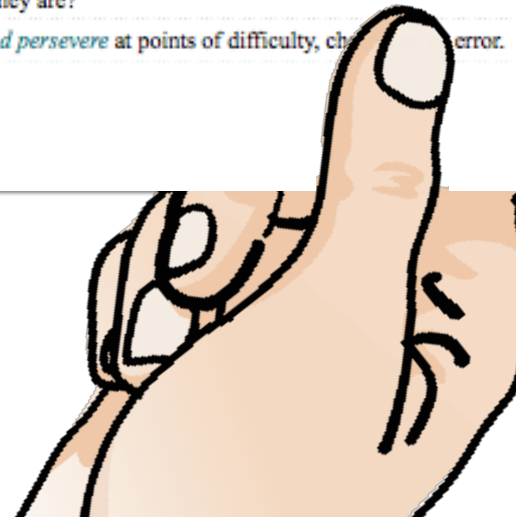
The Standards for

1. Make sense
2. Reason ab
3. Construc
4. Model wi
5. Use appr
6. Attend t
7. Look for
8. Look for

Count

SERP

| Principle   | Student Vital Action   | 3x5 Evidence Gathering Card |
|---|--|-----------------------------|
| 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. <i>Practices 1   2   3   6</i>   |                             |
| Reasoning develops when students develop viable arguments | Students <i>talk about each other's thinking</i> (not just their own). <i>Practices 1   2   3   6   7   8</i>  |                             |
| 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). <i>Practices 3   6</i>  |                             |
| 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.   |                             |
| 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. <i>Practices 1   2   3   6</i> |                             |
| Students write explanations                               | Students revise their thinking, and their written work includes <i>revised explanations</i> and justifications. <i>Practices 1   2   3   4</i>   |                             |
| 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?   |                             |
| Productive struggle, persistence                          | Students <i>engage and persevere</i> at points of difficulty, challenge, or error.   |                             |



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.

| Principle                | Student Vital Action   |
|--------------------------|--|
| Logic connects sentences | <p>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.</p> <p><i>Practices 1   2   3   6</i></p> |

A growth mindset matters

Productive struggle, persistence



OAKLAND UNIFIED  
SCHOOL DISTRICT  
Community Schools, Thriving Students

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.



SFUSD  
San Francisco  
Unified School District

**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 S.F. Math Teachers

# math.serpmedia.org

View all SERP Public Products

## SERP's Math Stuff

Please share with your colleagues!

Learn more about SERP

Strategic Education Research Partnership
1101 14th Street NW #300
Washington, DC 20005
(202) 223-8555
info@serpinstitute.org
serpinstitute.org

math.serpmedia.org

**AlgebraByExample**

[View SERP math stuff](#)
[How to get materials](#)

[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. effectively remediate repeated errors
3. fit readily with many different textbooks and teaching styles
4. support the Common Core Practice Standards
5. promote students' spontaneous mathematical discussions

**Helps students:**

- Identify, discuss, and reduce misconceptions
- Develop correct conceptual understanding
- Strengthen procedural skills

**Provides teachers:**

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

The SERP website partnership has been supported to conduct this work by The Goldman Sachs Foundation and the Institute of Education Sciences, U.S. Department of Education, through grant R03DA150103 to Strategic Education Research Partnership Institute.

provide one-page misperception

**Tools for Sense-making in Mathematics**

**View/Download Solutions**  
 Trilogies

**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, Phil Daro (SERP Bay Area Math Director and co-author of the Common Core State Standards in Mathematics), Professor Alan Schoenfeld (U.C. Berkeley), and a team of teachers and graduate students met monthly to explore together why 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 solve problems without understanding the situation described, or the question being asked. They looked for signals that would indicate whether to subtract, multiply, or perform some other operation. The question our group pursued was this: how can we shift the culture of the mathematics classroom away from answer-getting and toward sense-making? We are not suggesting that getting answers is a bad goal, but when it is the only goal, genuine learning is undermined.

We set out to identify relatively small shifts in practice that could create relatively big shifts in behavior and expanded to include fully designed diagnostic lessons. We hope others will find these strategies of value. If you try these out in your own classrooms, 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 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 those ultimately responsible for what goes on in classrooms—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 students' expertise in mathematical practices defined in the CCSS Mathematical Practice Standards 1 through 6. Extensive interaction of SERP's math team with school principals regarding their leadership of the shift to the CCSS-M Practices allowed for a detailed empathy process through which the expressed needs and dispositions of principals influenced the set of design specifications.

**Minimize reading.**

Principals insisted that they have neither the time nor the inclination to make their way through binders of materials. The card is named after the design commitment to provide principals with useful guidance that would fit on a Sx8 card.

**Use concrete, catalytic ideas that excite action.**

Principals' first efforts to be comprehensive, burdensome, and often lost the guidance they are offered again in ways that inhibit rather than stimulate action.

**Aim for a level of specificity regarding good instruction that is relevant across actors with different responsibilities and expertise.**

Principals acknowledge their role as instructional leaders. But they also insist that they cannot be highly expert in all content areas, and need tools that are realistic in the expertise they assume.

**Focus attention on student actions rather than teacher actions.**

The CCSS-M practices target specific actions expected of students. Teachers may have different ways to support students to make the shifts. It is student actions that need to be learned, and thus the student actions on which the teacher and principal should be focused.

[read more >](#)

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

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

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 | <b>430424</b> |
|---|---------------|

|      |               |
|------|---------------|
| 1–25 | <b>430430</b> |
|------|---------------|

|       |               |
|-------|---------------|
| 26–50 | <b>430431</b> |
|-------|---------------|

|       |               |
|-------|---------------|
| 51–75 | <b>479746</b> |
|-------|---------------|

|        |               |
|--------|---------------|
| 76–100 | <b>480219</b> |
|--------|---------------|

[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 | <b>479909</b> |
|------|---------------|

|       |               |
|-------|---------------|
| 26-50 | <b>479911</b> |
|-------|---------------|

|       |               |
|-------|---------------|
| 51-75 | <b>480220</b> |
|-------|---------------|

|        |               |
|--------|---------------|
| 76-100 | <b>480226</b> |
|--------|---------------|

[Results](#)

