#### @JULIESCHELL

**Dr. Julie Schell** is the senior educational researcher within the Mazur Group of the School of Engineering and Applied Sciences at Harvard University. She is a **seeker of educational change** across diverse contexts, such as disciplines, institutional types, and geographic locations. She is an expert in innovative approaches to student learning assessment, flipped classrooms, and Peer Instruction and is the Co-Founder of the Peer Instruction Network, the global community for innovative educators everywhere.



Her work to drive educational change extends beyond Harvard: She is an associate of LASPAU-Initiative for the Development of Academic Innovation (IDIA) affiliated with Harvard University. For IDIA, Dr. Schell focuses specifically on improving student learning assessment and pedagogy in Latin America and the Caribbean. She has played an integral role in educational reform initiatives across the region, including with the higher education division of the Chilean Ministry of Education (MECESUP), Ministry of Higher Education, Science and Technology division in the Dominican Republic, Universidad de Costa Rica, Universidad del Norte (Colombia) and Universidad Diego Portales (Chile).

Dr. Schell received her doctorate in Higher Education from Teachers College, Columbia University. She has an M.S. in instructional technology and authors the official Peer Instruction blog, *Turn to your Neighbor*, where she writes about innovative teaching and technology.

#### Tools for Assessing Change

## Google

conceptual inventory

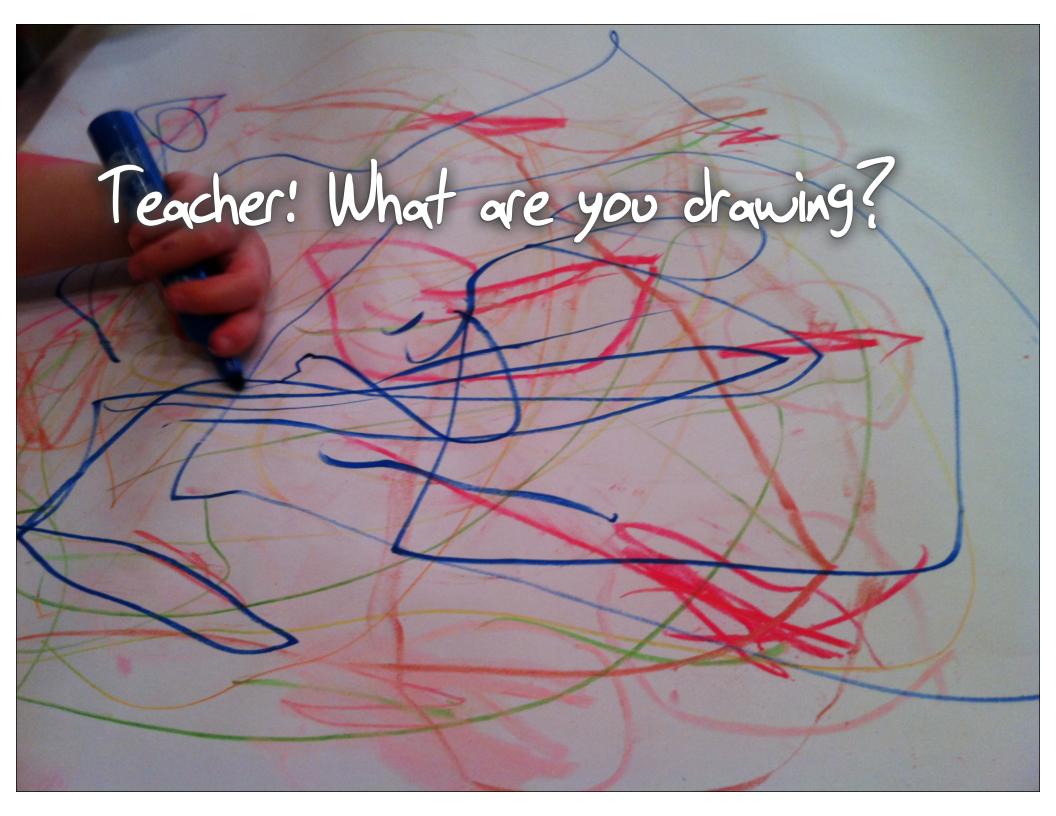
Google Search

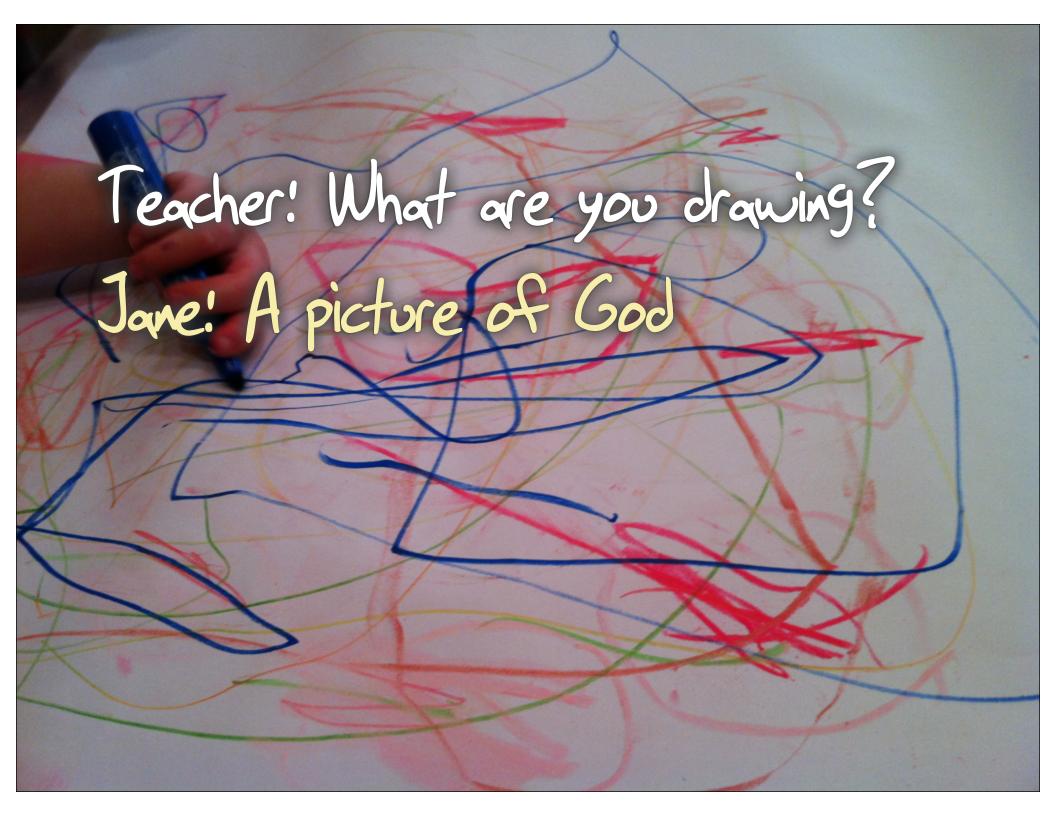
I'm Feeling Lucky

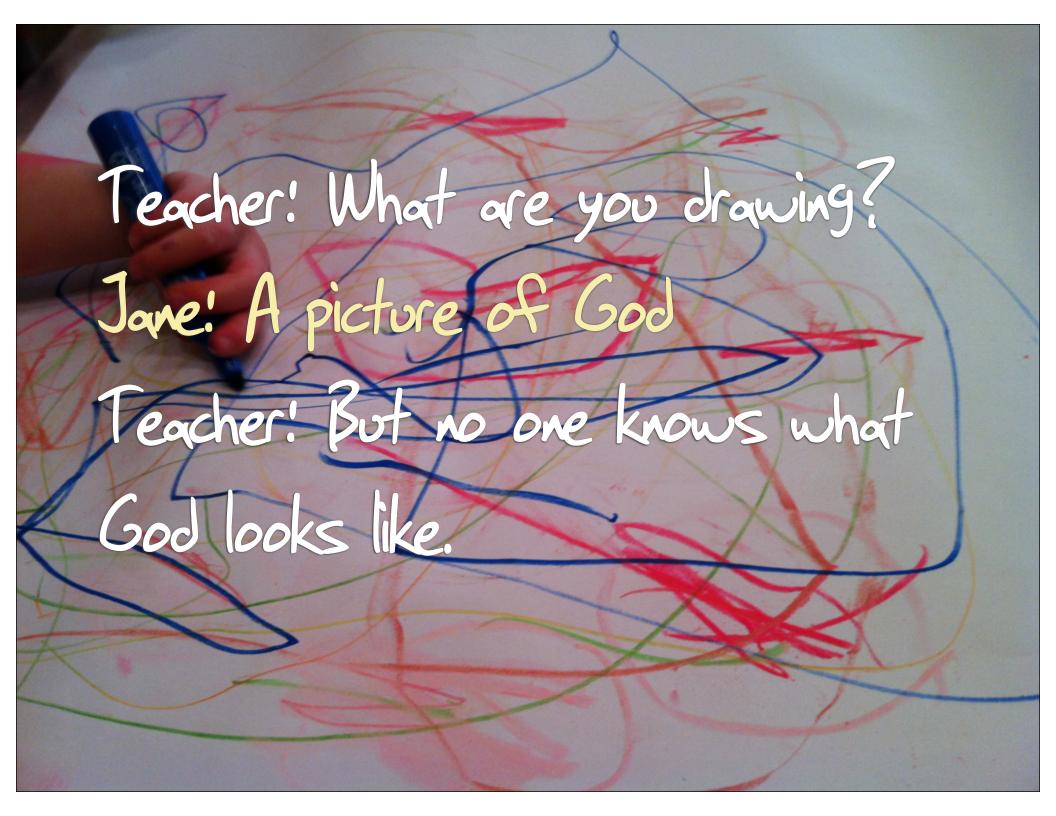
#### Tools for Assessing Change

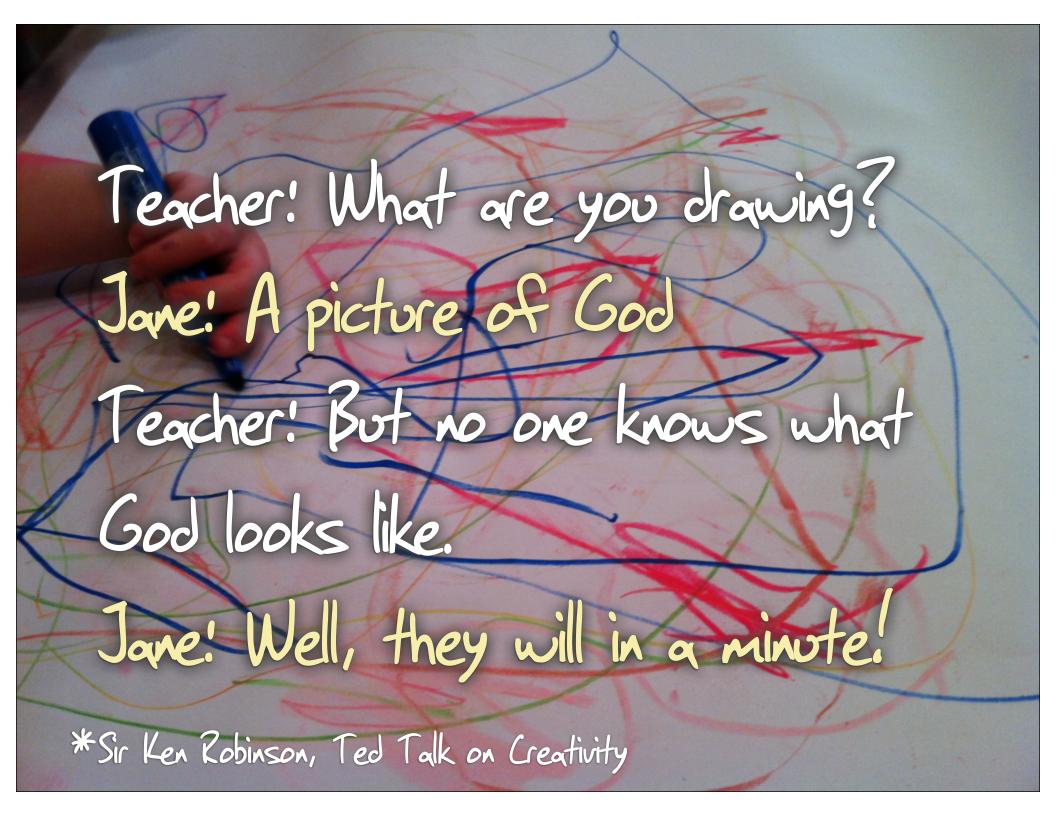




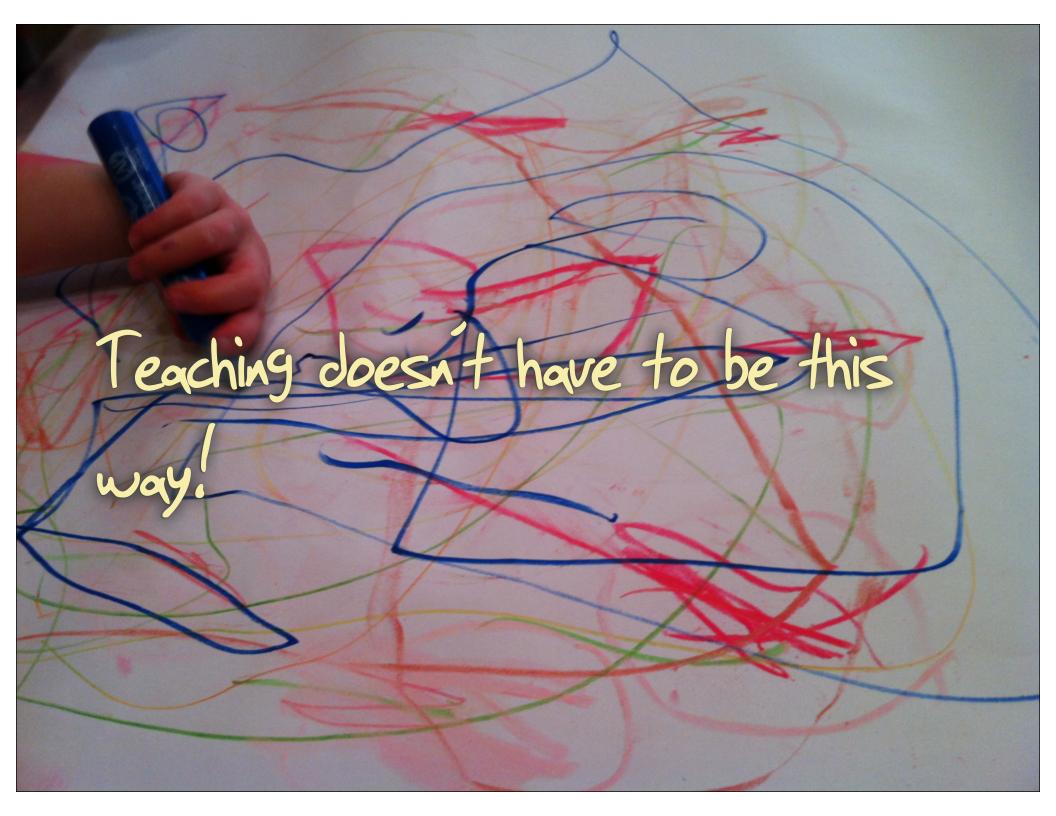












# **Assessment:**The Secret to Great Teaching



## Assessment: The Secret to Great Teaching

1. Setting the stage

The Secret to Great Teaching

1. Setting the stage Z-Posing the BIG question

The Secret to Great Teaching

- 1. Setting the stage
- 2 Posing the BIG question
- 3. Revealing the 5 strategies

## The Secret to Great Teaching

- 1. Setting the stage
- Z-Posing the BIG question
- 3. Revealing the 5 strategies
- 4. Taking the Next Steps

#### Setting the Stage

### Setting the Stage

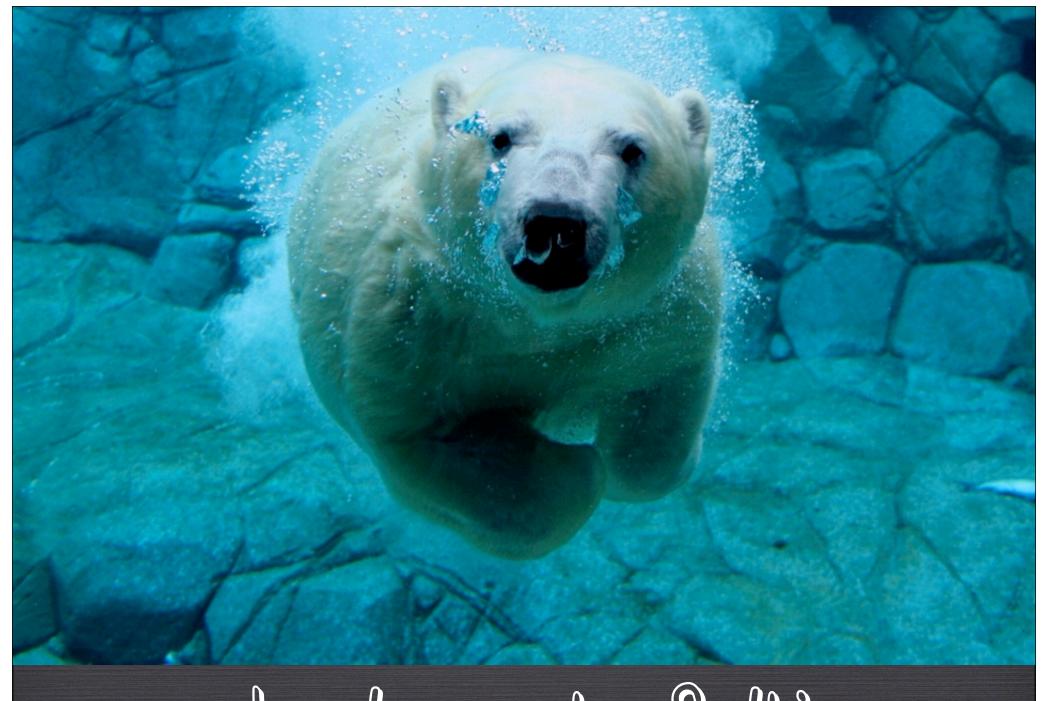
Performance is not learning.

### Setting the Stage

Too many assessments measure performance or surface learning, not deep learning.



We do foo moch of this....



and not enough of this.

#### Setting the Stage MESSAGE

#### Setting the Stage MESSAGE

new approaches to Use assessment to OUCONS! learning.

# Setting the Stage GDAL #1

That assessment is the secret to great teaching.

#### Setting the Stage GDAL #7

Torecommend 5 strategies for designing assessments that measure deep learning versus performance.

The Secret to Great Teaching

- 1. Setting the stage
- 2- Posing the BIG question
- 3. Revealing the 5 strategies
- 4. Taking the Next Steps

#### The Big Question

How can I use assessment to measure DEEP learning?















#### The Big Question

A related upestion

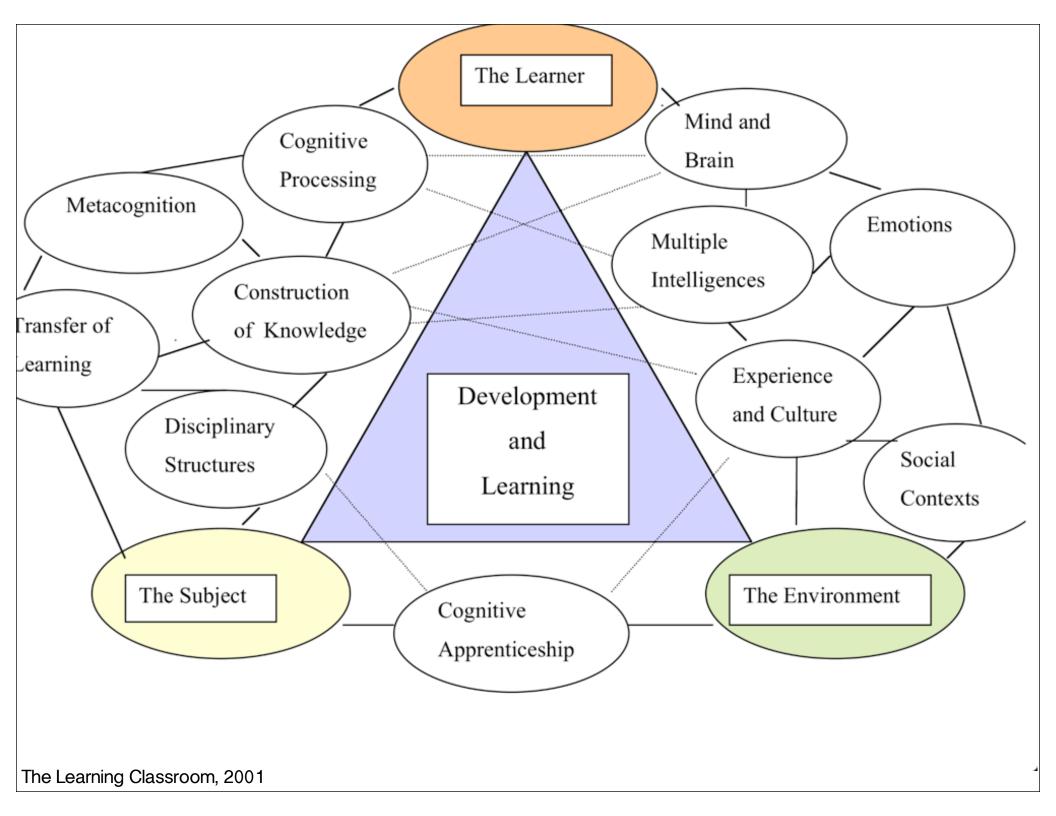
A related upestion

What is DEEP learning?

#### The Big Question

A related question

Note of the learning?



# The Big Question What is learning?

The Big Question What is learning?

Prior Knowledge x New Information

The Big Question What is learning?

Prior Knowledge x New Information

Learning=Changes in Prior Knowledge

Learning=Changes in Prior Knowledge

Surface Learning

Learning=Changes in Prior Knowledge

Surface Learning

Learning=Changes in Prior Knowledge

Surface Learning

Temporary, weak changes

Learning=Changes in Prior Knowledge

Deep Learning

Permanent, strong changes

Surface Learning

Temporary, weak changes

Learning=Changes in Prior Knowledge



Deep Learning

Permanent, strong changes

Surface Learning

Temporary, weak changes



### Assessment?

The Secret to Great Teaching

- 1. Setting the stage V
- 2 Posing the BIG question
- 3. Revealing the 5 strategies
- 4. Taking the Next Steps

### Bloom's Taxonomy (Revised)

Analyze

**Evaluate** 

Create

Cicacc

Higher Drder Cognition

**Apply** 

Understand

Remember

Lower Order Cognition

# Bloom's Taxonomy (Revised)

#### Remembering (Knowledge)

Useful Verbs	Sample Question Stems	Potential Activities and	
		Products	
tell	What happened after?	Make a list of the main facts.  Make a timeline of events.  Make a facts chart.  Write a list of any pieces of information you can remember.  List all the in the reading.  Make a chart showing	
list	How many?		
describe	Who was it that?		
relate	Can you name the?		
locate	Describe what happened at?		
write	Can you tell why?		
find	Find the meaning of?		
state	What is?		
name	Which is true or false?		

### 5 Straftegies

### S Strefteglies Pick a "linchpin" Concept



"Thus, a linchpin idea is the one that is essential for understanding, without which students cannot go anywhere...the most important enduring ideas" in an area of study.

\*Understanding by Design

### Strafeny 1

### Straftegy 1

Assess Change in Students

### Streffegy 1

Assess Change in Students

Protocol! Measure prior knowledge very early in course.

### Tools for Assessing Change

Conceptual Inventories! Tests designed with prior knowledge or common misconceptions in mind

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#### Tools for Assessing Change

Conceptual Inventories! Tests designed with prior knowledge or common misconceptions in mind

Pre-post Surveys! Surveys of concepts or attitudes given before and after instruction

Background Knowledge Probes! short questionnaires used at beginning or end of instruction

# Force Concept Inventory

Originally published in The Physics Teacher, March 1992

David Hestenes, Malcolm Wells, and Gregg Swackhamer

Revised August 1995

The Force Concept Inventory (FCI) is a multiple-choice "test" designed to assess student for standing of the most basic concepts in Newtonian mechanics. The Force Concept Inventory (FCI) is a multiple-choice "test" designed to assess student. The FCI can be used for understanding of the most basic concepts in Newtonian mechanics. The FCI can be used for several purposes, but the most important one is to evaluate the effectiveness of instruction. understanding of the most basic concepts in Newtonian mechanics. The FCI can be understanding of the most important one is to evaluate the effectiveness of instruction.

Several purposes, but the most important one is to evaluate the effectiveness of instrument and instrument and instrument of this instrument and instrument of the purposes, but the most important one is to evaluate the effectiveness of instrument and instrument and instrument of the purposes. l purposes, but the most important one is to evaluate the effectiveness of instruction.

How it is instrument and he is to evaluate the effectiveness of instruction.

How it is instrument and he is instruction. For a full understanding of what has gone into development of this instrument and how it can be used, the FCI papers (refs. 1, 2) should be consulted, as well as: (a) the Mechanics Raseline predecessor, the Mechanics Diagnostic Test (refs. 3, 4). (b) the paper on the Mechanics Diagnostic Test (refs. 3, 4). can be used, the FCI papers (refs. 1, 2) should be consulted, as well as: (a) the papers on Baseline Baseline predecessor, the Mechanics Diagnostic Test (refs. 3, 4), (b) the paper on the quantitative problem of the predecessor, the Mechanics Diagnostic Test (refs. 3, 4), (b) the paper on the quantitative problem.

predecessor, the Mechanics Diagnostic Test (refs. 3, 4), (b) the paper on the quantitative problem. Test (ref. 5), which is recommended as an FCI companion test for assessing university and high Test (ref. 5), which is recommended as an FCI companion test for assessing university and high solving skills. and (c) Richard Hake's paper (ref. 6) on data collection on university and the paper on t Test (ref. 5), which is recommended as an FCI companion test for assessing quantitative problem on data collection on university and high solving skills, and (c) Richard Hake's paper (ref. 6) on data collection on University and high solving skills, and (c) Richard Hake's paper and methods across the U.S.A. physics taught by many different teachers and methods across the U.S.A.

Refs. 1-5 are online at <a href="http://modeling.asu.edu/R&E/Research.html">http://modeling.asu.edu/R&E/Research.html</a> Refs. 1-5 are online at <a href="http://www.physics.indiana.edu/~hake>"http://www.physics.indiana.edu/~ solving skills, and (c) kichard Hake's paper (ref. b) on data collection on units school physics taught by many different teachers and methods across the U.S.A. school physics taught by many different teachers and methods across the U.S.A. Refs. 1-5 are online at <a href="http://modeling.acu.edu/R&F/Recearch html">http://modeling.acu.edu/R&F/Recearch html</a>.

References
1. D. Hestenes, M. Wells, and G. Swackhamer (1992). Force Concept Inventory, The Physics
Teacher 30. 141-151 ref. 24 at <a href="http://www.physics.indiana.edu/~hake">http://www.physics.indiana.edu/~hake</a>.

- Teacher 30, 141-151.

  2. D. Hestenes and I. Halloun (1995). Interpreting the Force Concept Inventory, The Physics

  Teacher 33, 502-506. Teacher 33, 502-506.
  3. I. Halloun and D. Hestenes (1985). The initial knowledge state of college physics students.

  Am. J. Phys. 53. 1043-1055. Am. J. Phys. 53, 1043-1055.

  4.1. Halloun and D. Hestenes (1985). Common sense concepts about motion, Am. J. Phys. 53, 1056-1065.

  - 1056-1065.
    5. D. Hestenes and M. Wells (1992). A Mechanics Baseline Test, The Physics Teacher 30, 159-166.
    6. R. Hake (1998). Interactive-engagement vs. traditional methods: A six thousand-student survey physics courses. Am. J. Phys 66, 64-74.
    6. R. Hake (1998) test data for introductory physics courses.

  - K. Hake (1998). Interactive-engagement vs. traditional methods: A six thousand-stoff mechanics test data for introductory physics courses. Am. J. Phys. 66, 64-74.

Conceptual Inventory

#### ORLH: Baseline Survey

#### Theory of Diversity

		Theory of Diversity	
		3.2 4 5 6 7 8 9 10 (I could teach a class	
13	ow comfortable you feel with your own knowledge of what a <b>theory</b> is?	(0) (zero comfort) 1 2 3 4 5 6 7 8 9 10 (test) (0) (zero comfort) 1 2 3 4 5 6 7 8 9 10 (t could teach a class on it)	
	How comfortable do you feel with your own knowledge of what diversity is?  If you were asked by an incoming student to define what a	by (0) (zero comfort) 1 2 3 4 5 6 7 8 9 10 (I could teach a class on it) int	
	to define what de theory of diversity is on the spot, how confident are you that you could do		

Pre-Post Survey

#### What kind of meter is this?



Background Knowledge Probe

Streftegy 1

Assess Change

### Straftegy Z

### Straftegy Z

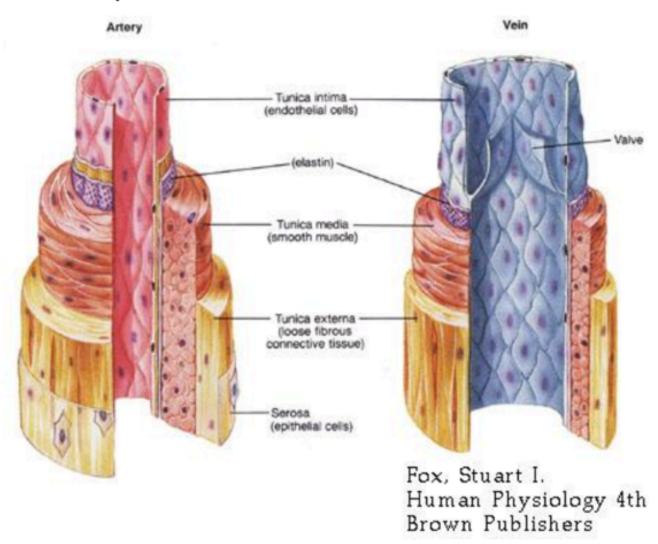
Assess Organization of Knowledge

### Straftegy Z

Assess Organization of Knowledge

Protocol! Measure how students structure and organize knowledge, and their understanding of how and why, not just memorization of discrete facts.

Blood vessels (arteries and veins) are the transport conduits of the circulatory system. *Arteries* transport blood away from the heart whereas *veins* transport blood towards the heart.



#### 1. Arteries

- a. Are more elastic than veins
- b. Carry blood that is pumped
- from the heart
- c. Are less elastic than veins
- d. Both a and b
- e. Both b and c

#### 1. Arteries

a. Are more elastic than veins b. Carry blood that is pumped

from the heart

c. Are less elastic

d. Both a and b

e. Both b and c

WHAT DOES THIS ASSESS?
Discrete Facts

Design an artificial artery.

Design an artificial artery.

Drganized Conceptual Framework

Design an artificial artery.

WHAT DOES Measure this!

Organized Conceptual Framework

### Tools for Assessing Organization

Performance Tasks! "A task that uses one's knowledge to effectively act or bring to fruition a complex product that reveals one's knowledge and expertise."\*\*

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Cioncept Maps! Diagrams of concepts and their relationships to other concepts, topics, or ideas

\*Understanding by Design

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Defining Feature Matrix! Categorization of concepts by defining features.

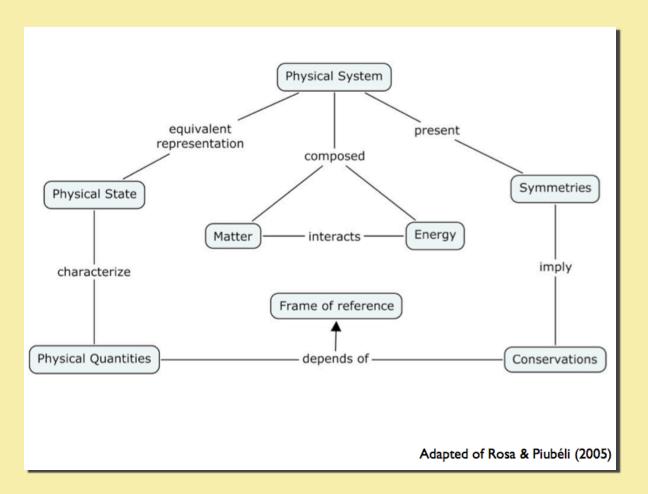
\*Understanding by Design

### Tools for Assessing Organization

Design an artificial artery.

Performance Tasks

### Tools for Assessing Organization



Concept Map

#### Tools for Assessing Organization

"Mark, using + or -, whether sound and EM waves can have the associated wave concept (three sample answers given).

Wave Concept	Sound Waves	EM Waves	Matter Waves
allows polarization	_	+	_
pulse or shock			
periodic			
rqrs medium			
carries energy	••	••	
transverse		••	
longitudinal	••	••	

Defining Feature Matrix

# Straftegy Z

Assess Organization of Knowledge

# Strafegy 3

# Straftegy 3

Assess Sophistication of the Basics

# Straftegy 3

Assess Sophistication of the Basics

Protocol! Measure how well students grasp a series of basic understandings about concepts.







Performance Tasks! "A task that uses one's knowledge to effectively act or bring to fruition a complex product that reveals one's knowledge and expertise."\*

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Presentations' student led, formal talks that teach concepts or ideas

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Presentations! student led, formal talks that teach concepts or ideas Student Questions! Have students write questions they think would assess deep learning and include their own explanations

Performance Tasks! "A task that uses one's knowledge to effectively act or bring to fruition a complex product that reveals one's knowledge and expertise."\*

Presentations! student led, formal talks that teach concepts or ideas Student Questions! Have students write questions they think would assess deep learning and include their own explanations Invented Dialogues! structured, invented dialogues, between important leaders in the field

Prompt:

Prepare a 15 minute presentation to explain and demonstrate how arteries and veins function.

Presentations

#### Prompt:

Prepare three questions you think would assess your peers' understanding of the structure and function of arteries and veins, we will select the best questions to be used in class, make sure you include explanations.

Student Questions

Title	
Setting	
Characters	

#### **Dialogue**

Character A:

Character B:

Character A:

Character B:

Invented Dialogue

# Straftegy 3

Assess Sophistication of the Basics

# Straftegy 3

Assess Sophistication of the Basics

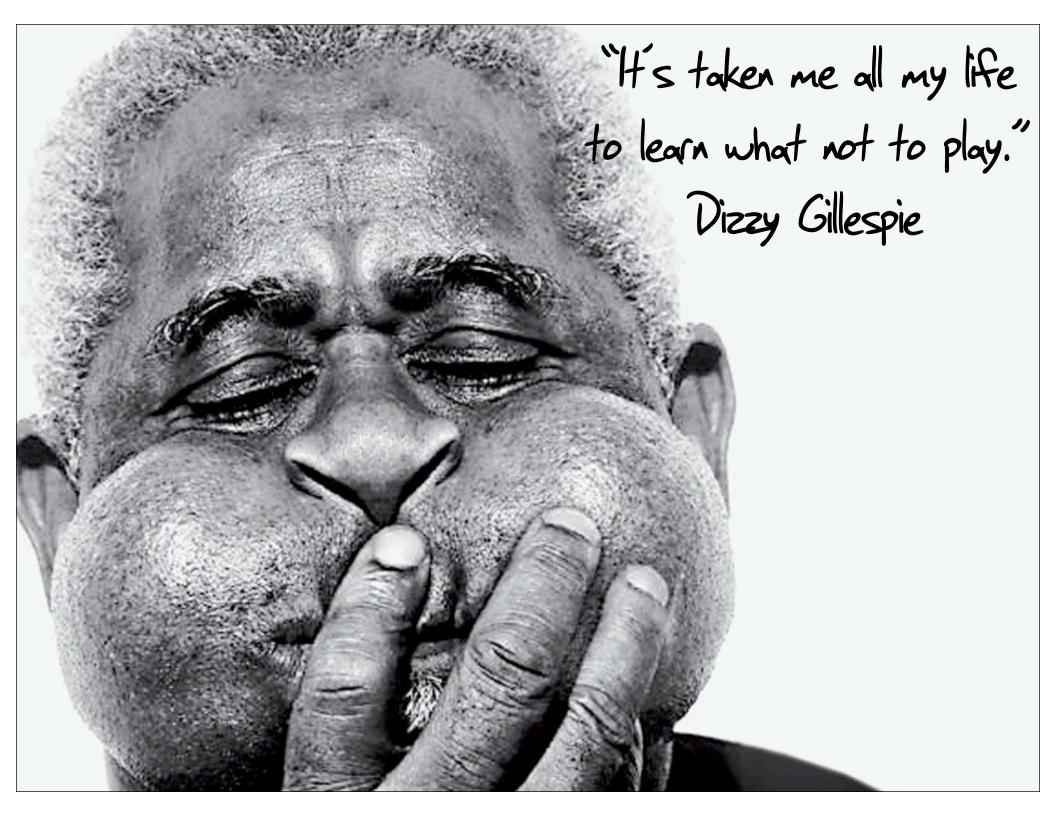
# Strafegy 4

### Streffegy 4

Assess Self Assessment

Protocol! Measure how accurate students are in their own assessment of their abilities.





One Minute Paper! students write short answer responses to two questions at the end of class.

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Just-in-Time Teaching! method to prepare students before class, using conceptual questions and the Muddiest Point Technique

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Muddlest Point Technique! Students response to 1 question about the most confusing point of instruction or reading

\*Understanding by Design

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Muddiest Point Technique! Students response to 1 question about the most confusing point of instruction or reading

Rubrics! "A criterion-based scoring guide that enables judges to make reliable judgments about student work and enables students to self-assess."

\*Understanding by Design

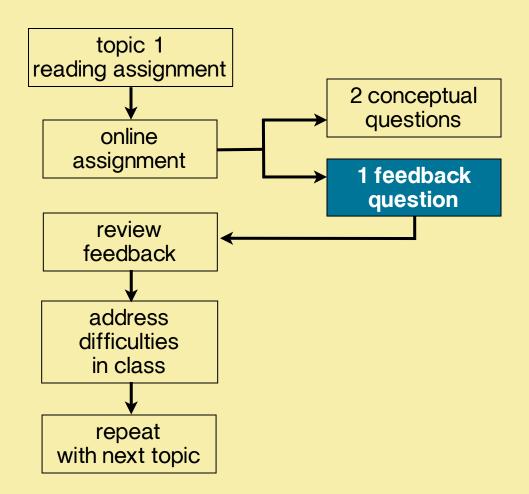
Assessment Wrapper! A self-assessment question students answer and hand in at the end of an assessment.

\*Understanding by Design

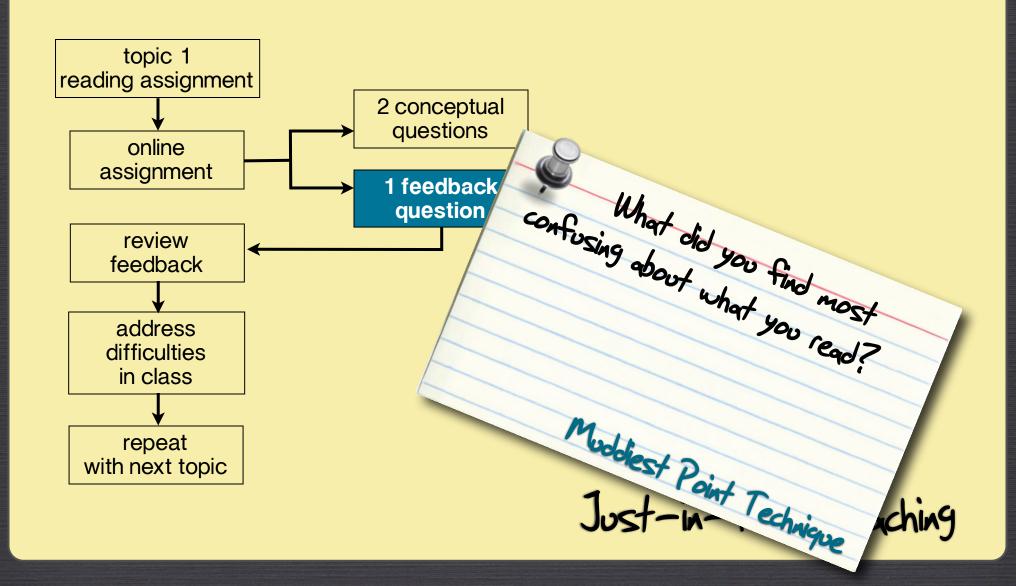


thing you learned in this class?
What important question remains

One Minute Paper



Just-in-Time Teaching



	novice	developing	expert
Precision	X		
Estimation		X	
Calculations	X		
Strategy			X



assessment, what would you do

Assessment Wrapper

# Straftegy 4

Assess Self Assessment

# Straftegy 5

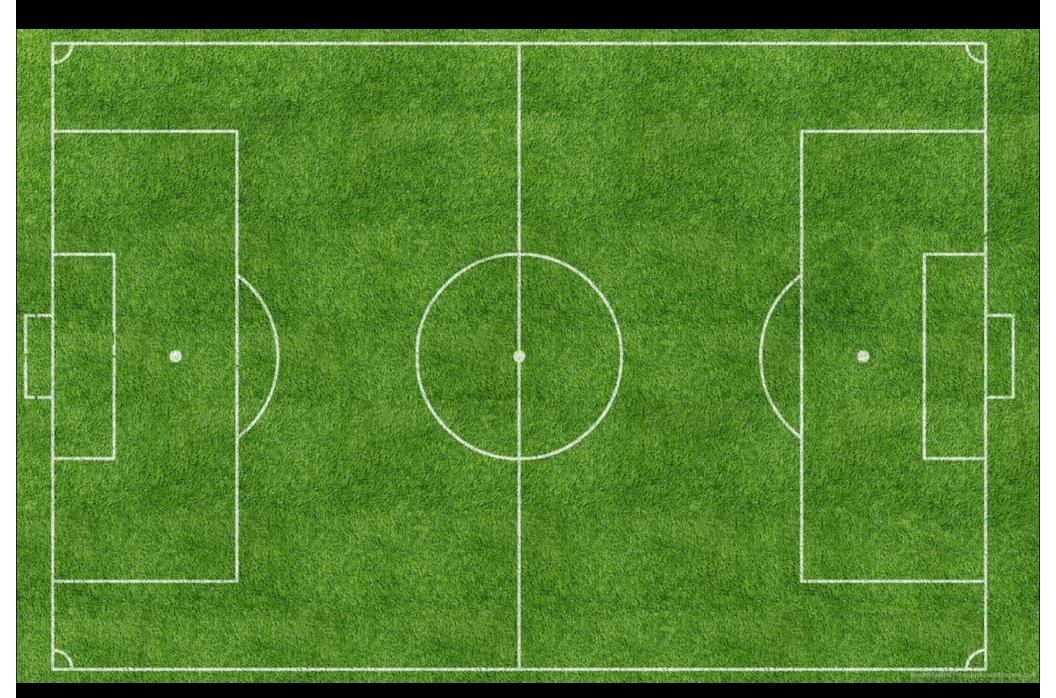
# Strafegy 5

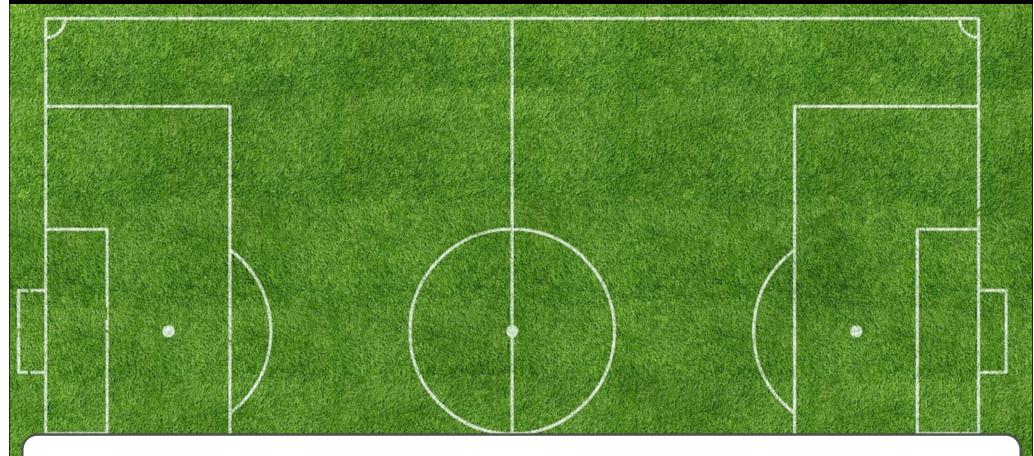
Assess for Knowledge Transfer

### Straftegy 5

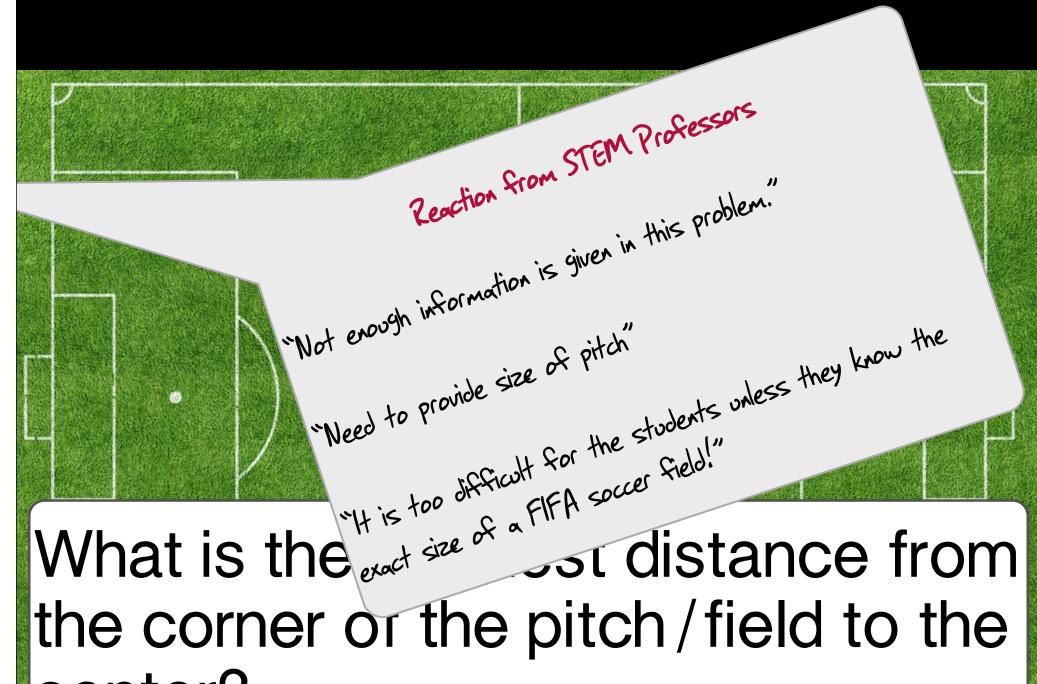
Assess for Knowledge Transfer

Protocol! Measure how well students use heuristic versus procedural knowledge.

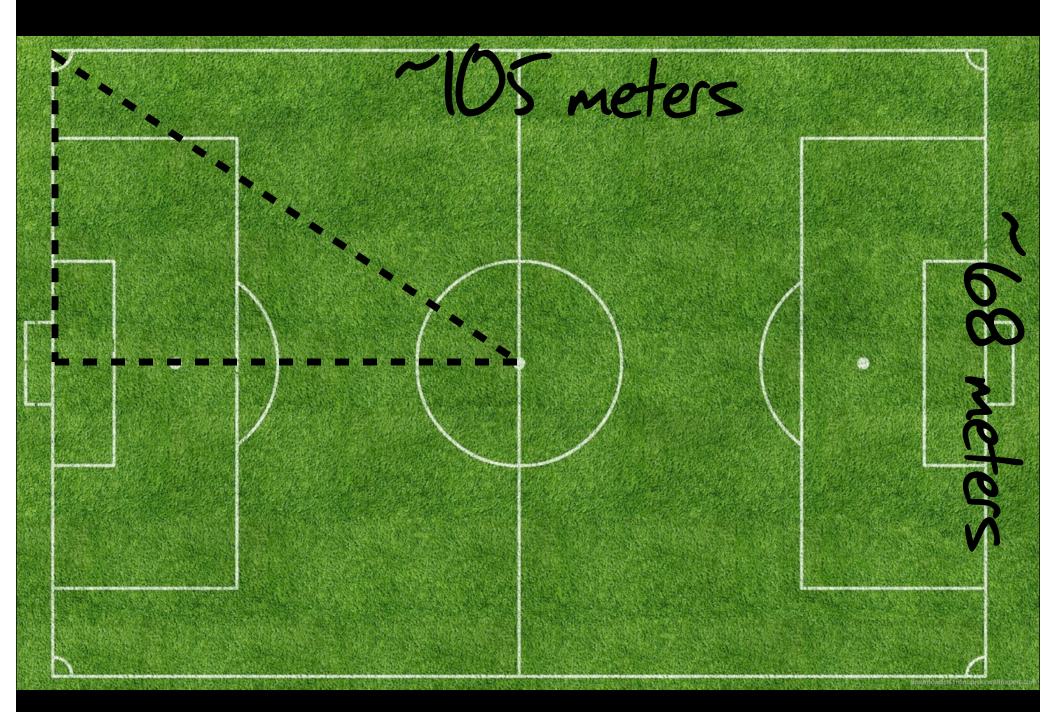


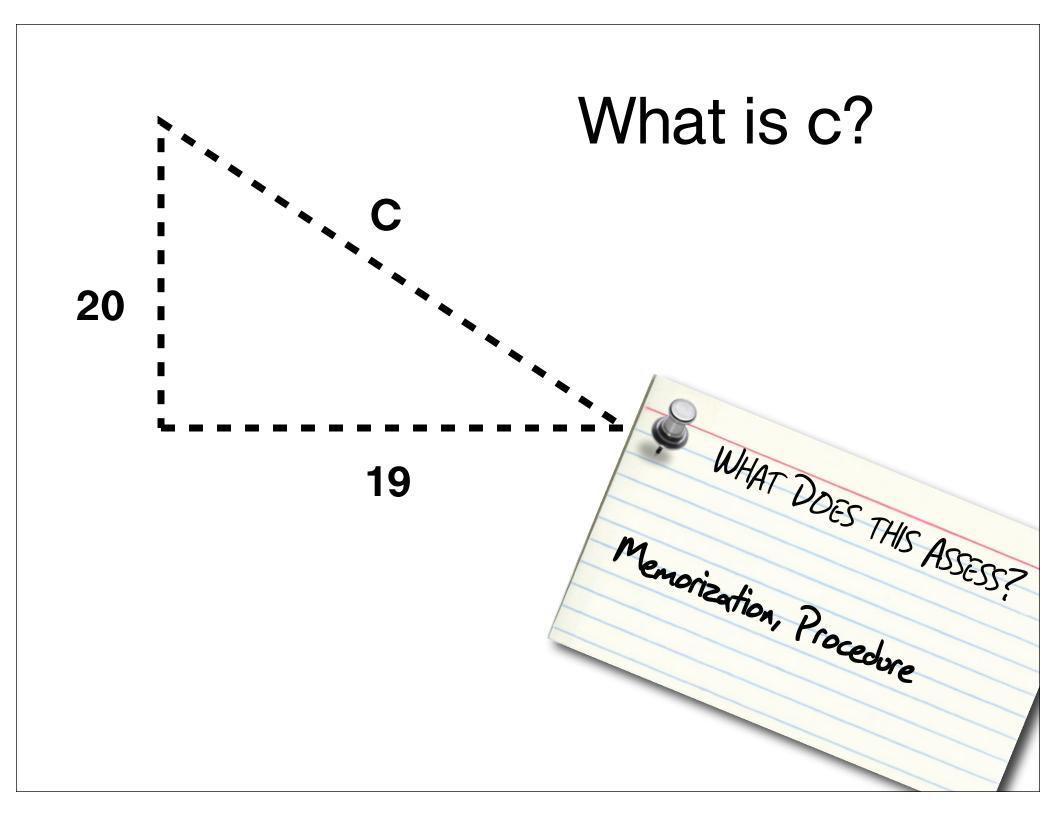


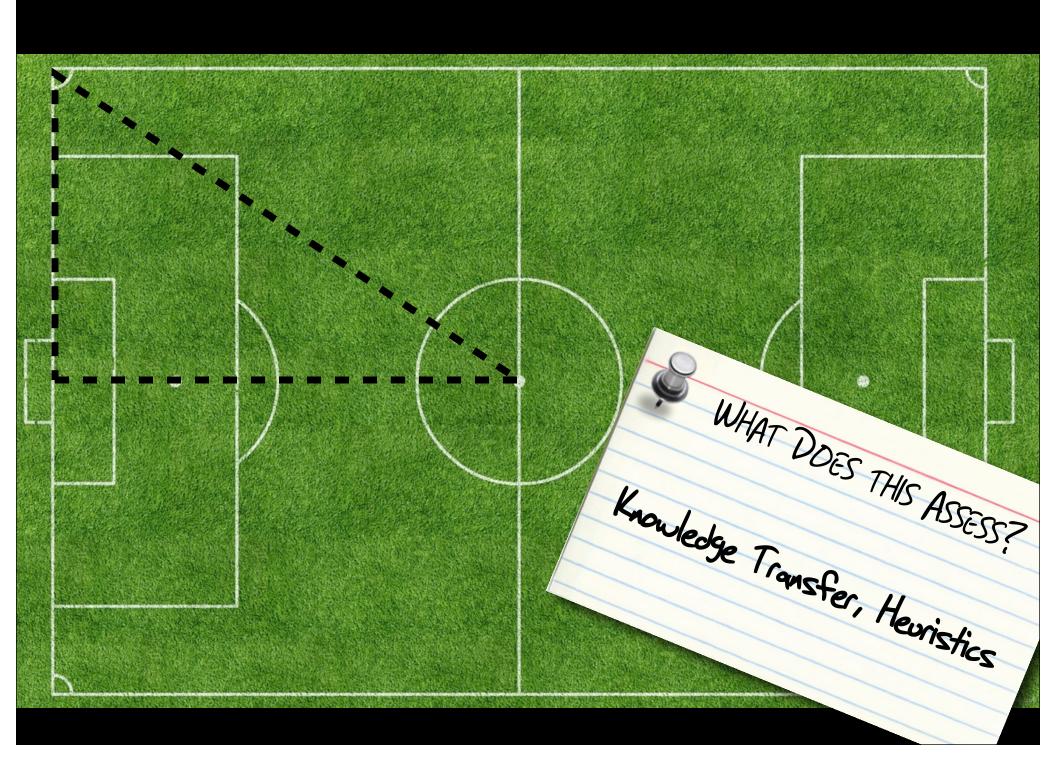
What is the shortest distance from the corner of the field to the center?

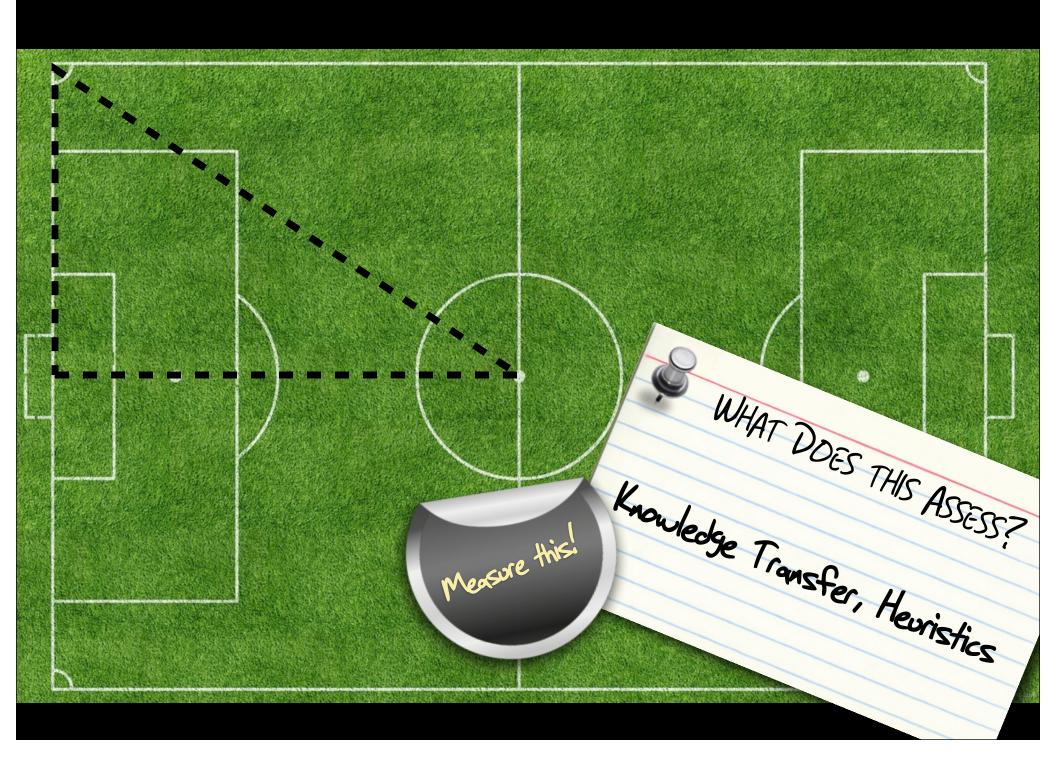


Soldistance from the corner or the pitch/field to the center?









Performance Tasks! "A task that uses one's knowledge to effectively a or bring to fruition a complex product that reveals one's knowledge and expertise."\*

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ConcepTests! Short concept questions that test students' ability to transfer knowledge.

Performance Tasks: "A task that uses one's knowledge to effectively a or bring to fruition a complex product that reveals one's knowledge and expertise."\*

Concept ests: Short concept questions that test students' ability to transfer knowledge.

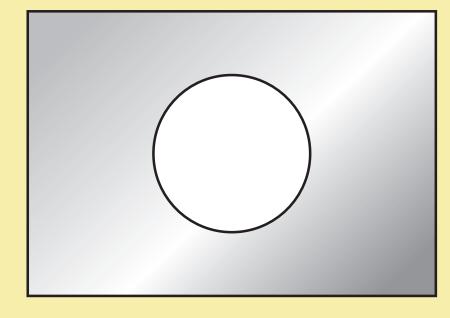
Application Cards! Prompts that asks students to imagine practical applications for concepts they are learning in class.

Consider a metal plate with a hole in it...if you heat it up uniformly what will happen to diameter of hole?

A. increases

B. stays the same

C. decreases



ConcepTest



What is a real world application expansion? Hermal

Application Card

### Strafegy 5

Assess for Knowledge Transfer

### 5 Strafegies

	Surface Learning	Deep Learning
CHANGE		+
DRGANIZATION		+
SOPHISTICATED BASICS		+
SELF-ASSESSMENT		+
KNOLWEDGE TRANSFER		+

## 5 Strafegies

# Quick Start Guide

#### 5 Strategies for Assessing Deep Learning 1 Assess change in students' knowledge Julie Schell

- i. Conceptual Inventories: Tests designed with prior knowledge or a. Possible Tools
  - ii. Pre-post Surveys: Surveys of concepts or attitudes given before and Background Knowledge Probes: short questionnaires used at

- is Performance Tasks: "A task that uses one's knowledge to effectively act or bring to fruition a complex product that reveals one's ii. Concept Maps: Diagrams of concepts and their relationships to other 2 Assess for Organized Knowledge a. Possible Tools
  - Thing Feature Matrix: Categorization of concepts by defining
    - concepts, topics, or ideas

### Assessment?

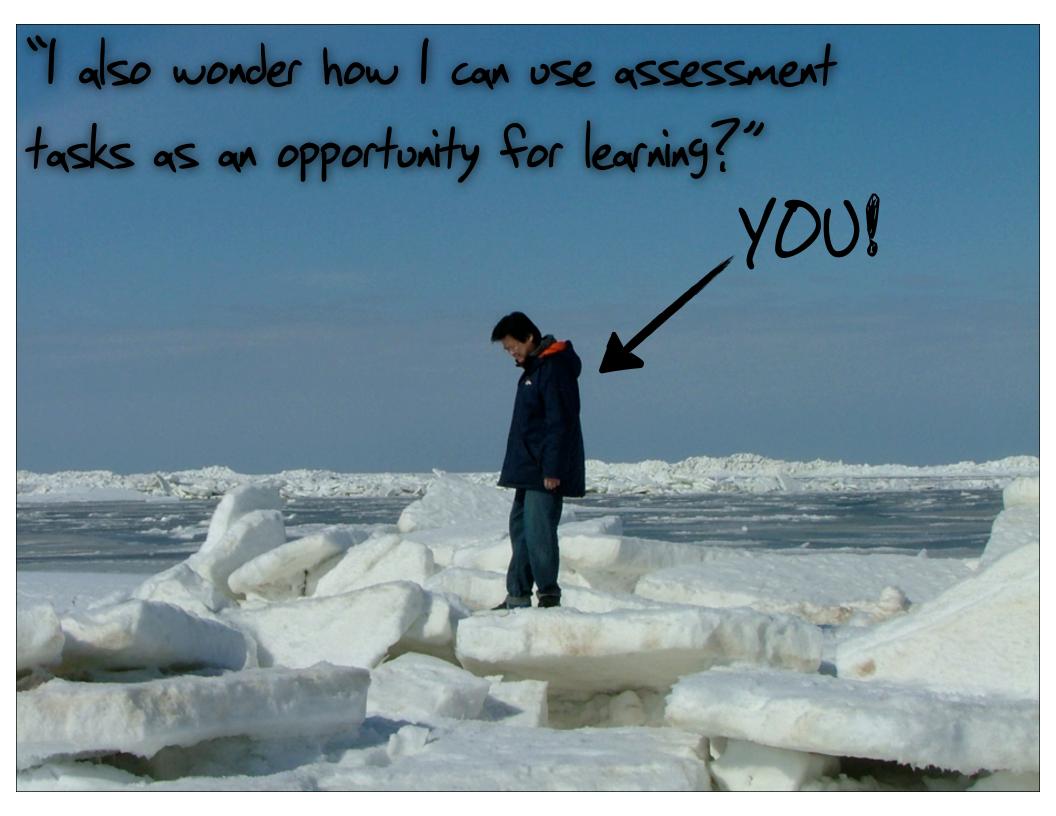
The Secret to Great Teaching

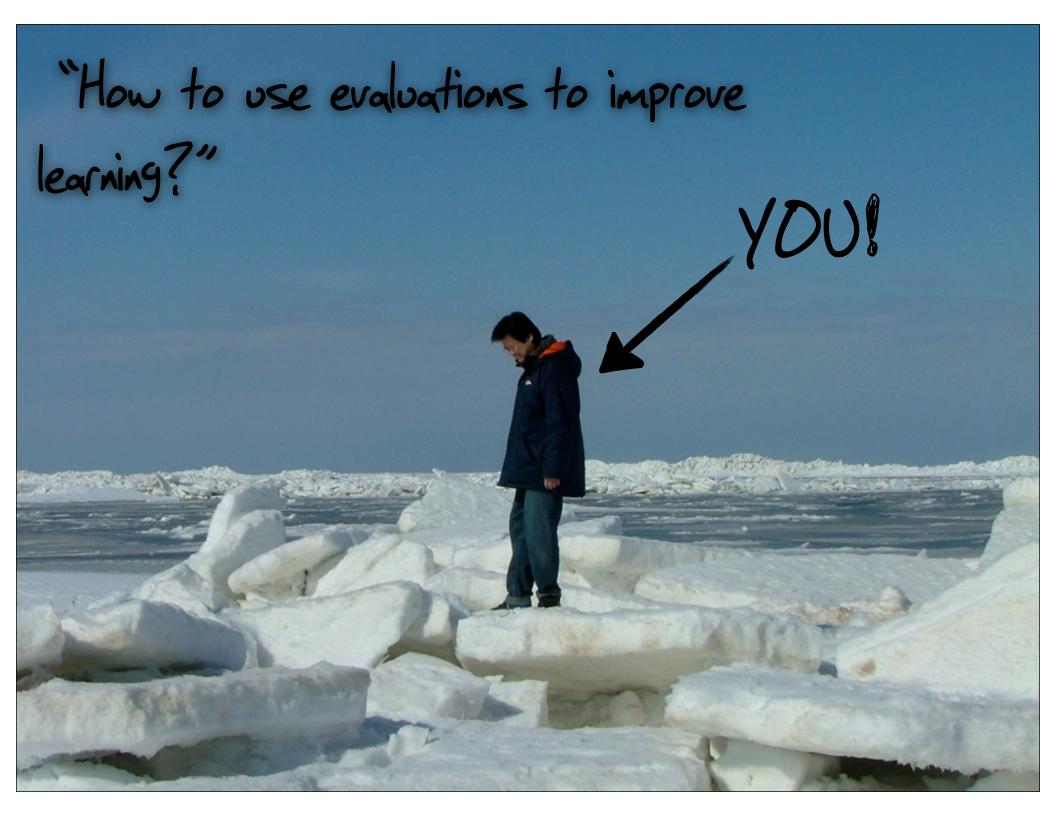
- 1. Setting the stage V
- 2- Posing the BIG question
- 3. Revealing the 5 strategies V
- 4. Taking the Next Steps













### Next Steps

You can't teach new ways and assess old ways.

### Next Steps

new approaches to Use assessment to ONGOV21 learning.





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Ives Araujo
Cassandre Alvarado
Jen Ebbeler



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