BRIAN LUKOFF, PH.D.
APRIL 14, 2015

BUT EVERYTHING MADE
SENSE IN CLASS!

A blue speech bubble with a white outline and a small tail pointing to the left. It contains the text "But everything made sense in class!" in white, sans-serif font.

But everything made sense in
class!

A blue speech bubble with a white outline and a small tail pointing to the left. It contains the text "The exam was nothing like the homework!" in white, sans-serif font.

The exam was nothing like the
homework!

A blue speech bubble with a white outline and a small tail pointing to the left. It contains the text "The test wasn't an accurate reflection of my true knowledge!" in white, sans-serif font.

The test wasn't an accurate
reflection of my true knowledge!

Three problems

1. Students don't understand fundamental concepts

1. Students don't understand fundamental concepts
2. Students don't know what they don't know

1. Students don't understand fundamental

2. Students don't know what they know

Journal of Personality and Social Psychology
1999, Vol. 77, No. 6, 1121-1134

Unskilled and Unaware of It: How Difficulties in Recognizing One's Own Incompetence Lead to Inflated Self-Assessments

Justin Kruger and David Dunning
Cornell University

People tend to hold overly favorable views of their abilities in many social and intellectual domains. The authors suggest that this overestimation occurs, in part, because people who are unskilled in these domains suffer a dual burden: Not only do these people reach erroneous conclusions and make inappropriate choices, but their incompetence robs them of the metacognitive ability to realize it. Across 4 studies, participants scoring in the bottom quartile on tests of humor, grammar, and general intelligence and ability. Although their test scores put them in the bottom quartile, their self-assessments were inflated. Paradoxically,

Copyright 1999 by the American Psychological Association, Inc.
0022-3514/99/\$3.00

Day 7

Day 6

Day 5

Day 4

Source: Poh, M. Z., Swenson, N. C., & Picard, R. W. (2010). A Wearable Sensor for Unobtrusive, Long-Term Assessment of Electrodermal Activity. IEEE Transactions on Biomedical Engineering 57(5).

1. Students don't understand fundamental concepts
2. Students don't know what they don't know
3. We are not engaging students in enough meaningful practice in class

$$M(H^0) = \pi \left(\frac{1}{137} \right)^8 \sqrt{\frac{hc}{G}}$$

$$3987^{12} + 4365^{12} = 4472^{12}$$

$$\Omega(t_*) > 1$$

Technology is the answer!

~~Technology is the answer!~~

~~Technology is the answer!~~

Technology is a vehicle for pedagogical change.

Assessment

Assessment

formative

summative

Assessment

formative

summative

Goal: Accurately
measure student
understanding for
purposes of giving a
grade

Assessment

formative

Goal: Improve
instruction by
identifying strengths
and weaknesses

summative

Goal: Accurately
measure student
understanding for
purposes of giving a
grade

Interactive teaching
Traditional lecture

Source: Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *Am. J. Phys.* 66(1).

If it ain't broke...

Limitations of traditional clicker questions

Learning objective:

Students understand how transformations of a random variable do or do not impact its variance / SD

If X is a random variable, then $SD(1 - X)$

- A. is less than $SD(X)$.
- B. is equal to $SD(X)$.
- C. is greater than $SD(X)$.
- D. cannot be determined.

Student answers
correctly

Student understands
the concept

Student answers
correctly

Student understands
the concept

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STUDENT RESPONSE CONTAINS
ONLY 2 BITS OF INFORMATION!

If a student selected the **right** answer, did they:

If a student selected the **right** answer, did they:

- understand the concept?

If a student selected the **right** answer, did they:

- understand the concept?
- recall a rule they read in the textbook?

If a student selected the **right** answer, did they:

- understand the concept?
- recall a rule they read in the textbook?
- guess?

If a student selected the **right** answer, **they** might think:

If a student selected the **right** answer, **they** might think:

- I understand the concept!

If a student selected a **wrong** answer, did they:

If a student selected a **wrong** answer, did they:

- have a specific misconception (which one?)

If a student selected a **wrong** answer, did they:

- have a specific misconception (which one?)
- try to blindly apply a rule, but fail?

If a student selected a **wrong** answer, did they:

- have a specific misconception (which one?)
- try to blindly apply a rule, but fail?
- guess incorrectly?

A group of students in a classroom setting. In the foreground, a student is pointing towards the camera with their right hand. Other students are visible in the background, some looking towards the camera and others looking away. The text "Challenges with peer discussion quality" is overlaid on the image.

Challenges with peer discussion quality

How can we make use of the Data?

How can we make use of the data?

More sophisticated devices, that students already have

More sophisticated activities and thinking processes

learning | **catalytics**

learning | **catalytics**

Developed at Harvard starting in 2010

learning | **catalytics**

Developed at Harvard starting in 2010

Spun out into a startup in 2011

learning | **catalytics**

Developed at Harvard starting in 2010

Spun out into a startup in 2011

Acquired by Pearson in 2013

eating our own dog food

If X is a random variable, then $SD(1 - X)$

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Here is the histogram for points scored. On top of this histogram, draw a histogram for another variable that would have the SAME standard deviation as points scored.

Carrier

8:43 PM

learningcatalytics.com

Refresh

Session 97921093

Logout

sketch question

Here is the histogram for points scored. On top of this histogram, draw a histogram for another variable that would have the SAME standard deviation as points scored.

[✕ Clear sketch](#)

Submit

[T Switch to text response](#)

$15x^5$: 25%
$16x^5$: 6%
$2.5x^3 - 2.5$: 6%
$25x^4/2$: 6%
$3x^2(5x^3)$: 6%
$5(x^3)(3x^2)$: 6%
$5x^3$: 31%
$5x^3 \cdot 3x$: 6%
$f(x^2)(2x)$: 6%

2: 2%
$-1/2$: 10%
.5: 38%
$1/2$: 29%
0.5: 14%
$-x^{(-1)}$: 2%
$-.5$: 2%
$-3/2$: 2%

[+ Add seat](#) [+ Add block of size](#) across x down ? [Instructions](#)

back of room

front of room

Science Center B

Save

Learning Catalytics

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Reader

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Brian Lukoff | Pearson | Log out

CoursesQuestionsClassroomsTourHelp

Student view

Classrooms > Science Center B

+ Add seat

+ Add block of size

5 across × 5 down ? Instructions

back of room

front of room

Name Science Center B

Save

ALWAYS LEARNING

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Carrier 5:21 PM

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Select seat Logout

Enter the seat number you are sitting in:
D15 or Show seat map

Click the seat you are sitting in:
Scroll left Scroll right

front of room

Seat map

B					B	B			
		B						A	
A	B	B							
			B			B		B	B
			B			A			A
			A	A	B	A			C
		A					B	A	B
B	A	B	B	A			B	B	B
					A				
	B		B		B		A	B	
A						B		B	
						B		A	A

								B	
								B	B
B	B					A	B	A	
B						A			A
					A			A	C
B		B				A			
B									B
B		B	B	B	B				
B		B						B	
A				B	A				B
B		A	C		B	A			

Refresh

Seat map

learningcatalytics.com

Refresh

Session 26472566

Logout

multiple choice question

A meteorologist predicts a 40% chance of rain in London and a 70% chance in Chicago. What is the most likely outcome?

Please discuss your response with:

- **Kate Jones** (to your right)
- **Sarah Smith** (to your right)

A. It rains only in London

B. It rains only in Chicago

C. It rains in London and Chicago

D. It rains in London or Chicago

Seat map

learningcatalytics.com

Refresh

Session 26472566

Logout

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Create module Copy a module

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Search: ____							
Module	◇	Type	◇	Date	▲	Results	
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Limits		Synchronous		2012-09-20			
Infinite Limits and Limits at Infinity		Synchronous		2012-09-25			
Continuity		Synchronous		2012-09-27			
The derivative		Synchronous		2012-10-02			
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L'Hopital's Rule		Synchronous		2012-11-08			
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Optimization		Synchronous		2012-11-27			
Antiderivatives and Indefinite Integrals		Synchronous		2012-11-29			
Integration by Substitution		Synchronous		2012-12-04			
Integration by substitution practice		Self-Test		2012-12-04			
The definite integral		Synchronous		2012-12-06			

ASYNCHRONOUS USE, TOO

- Self-paced assessments (e.g., quizzes, homework, JiTT)
- Self-test, with instant feedback
- Team-based assessment
- Automated synchronous (for online courses)

“Education is what remains after one has forgotten
what one has learned in school.”

- ALBERT EINSTEIN

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THANK YOU!