BUT EVERYTHING MADE SENSE IN CLASS!
But everything made sense in class!

The exam was nothing like the homework!

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 concepts.

2. Students don’t know what they don’t know.

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 unfortunate choices, but their incompetence robs them of the metacognitive ability to realize it. Across 4 domains, researchers found that participants scoring in the bottom quartile on tests of humor, grammar, and music competence and ability. Although their test scores put them in the lowest third of their peers, they perceived themselves as competent. In a separate study, several analyses linked this miscalibration of skill to the belief in personal control over achievement.
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
\[ M(H^0) = \pi \left( \frac{1}{137} \right)^{8/3} \sqrt{\frac{h c}{G}} \]

\[ 3987^{12} + 4365^{12} = 4472^{12} \]

\[ \Omega(t.) > 1 \]
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
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 $\text{SD}(1 - X)$

A. is less than $\text{SD}(X)$.
B. is equal to $\text{SD}(X)$.
C. is greater than $\text{SD}(X)$.
D. cannot be determined.
Student answers correctly -> Student understands the concept
Student answers correctly ? Student understands the concept
If $X$ is a random variable, then $\text{SD}(1 - X)$

A. is less than $\text{SD}(X)$.
B. is equal to $\text{SD}(X)$.
C. is greater than $\text{SD}(X)$.
D. cannot be determined.
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.
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?
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
Developed at Harvard starting in 2010
Developed at Harvard starting in 2010

Spun out into a startup in 2011
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 $\text{SD}(1 - X)$

A. is less than $\text{SD}(X)$.
B. is equal to $\text{SD}(X)$.
C. is greater than $\text{SD}(X)$.
D. cannot be be determined.
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.
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Seat map
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
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)
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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
THANK YOU!