

winner spent part of his prize  
money on teaching  
undergraduates, and raised  
\$5 million more for the same  
cause?

A. Harvard

B. Caltech

C. Colorado

CU's Carl Wieman





# Why Use Science on a Sphere in an interactive way with “Clickers” ?



Dr. Douglas Duncan  
Director, Fiske Planetarium  
University of Colorado, Boulder



# How many of you:

- A. Have never used clickers
- B. Have used clickers once
- C. Have used clickers more than once



# ***Why use clickers?***

1. Visitor learn less than we think they do when we do all the talking
2. Some subjects are touchy, and anonymity is useful.
3. It's ***Fun!***

*Who wants to be a  
millionaire?*

**We've been teaching the same way for a long time...**

2000 years ago



Today

*How effective are we?*



# How well do students learn in a lecture? A cautionary tale....

A. about a violin....

From Carl Weiman's\*  
"Physics of Everyday Life"  
class.

\*Nobel prize winner AND  
good teacher



Measures of retention of information from lecture,  
with and without clicker based questions.

Explaining about sound and how a violin works.

I show class a violin and tell them that the strings cannot move enough air to produce much sound, so actually the sound comes from the wood in the back. Point inside violin to show how there is a sound post so strings can move the bridge and sound post causes back of violin to move and make sound. 15 minutes later in the lecture I asked students a question the sound they hear from a violin is produced by

- a. mostly by strings, b. mostly by wood in back,
- c. both equally, d. none of the above.

What fraction gave the correct answer?

- a. 0%, b. 10 %, c. 30%, d. 70%, e. 90%

(b) Only 10% of students gave the correct answer.

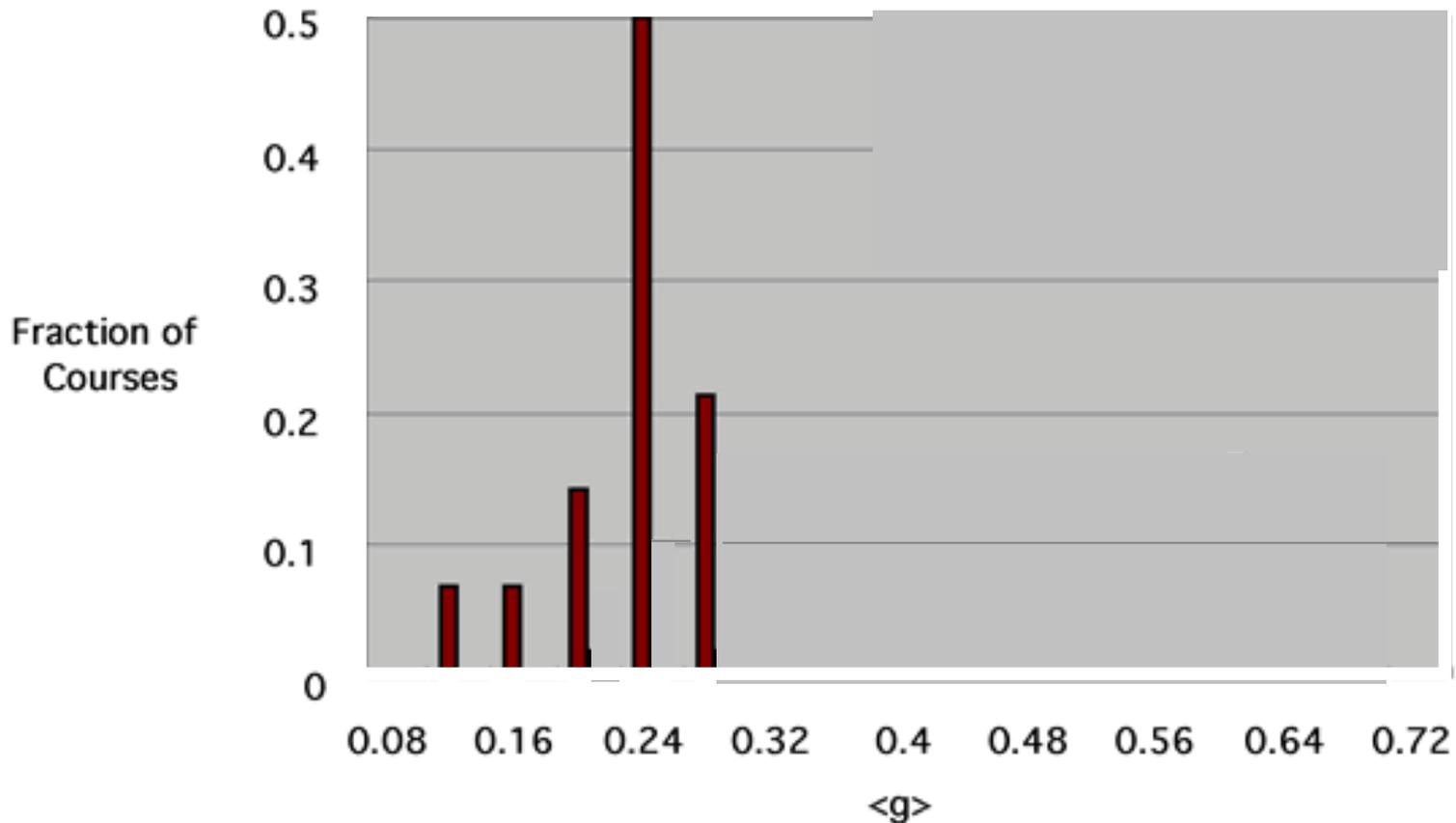
Fifteen minutes later in the same lecture!

*That was an anecdote...*

*Now for data*

*In a traditional lecture class, students learn about 25% of the concepts (that they don't already know).*

## traditional lecture



R. Hake, "...A six-thousand-student survey..." AJP 66, 64-74 ('98).

# Traditional Model of Education

**Individual**      **Instruction via**  
←—————  
**transmission**      **Content**





Learning takes place in the mind of the student or visitor, not your mind!

*So let **them** become more active!*

# **What do you think about Global Warming?**

- A. I think it's a serious problem
- B. I think it's overly hyped
- C. What's global warming?

Every few years we add a “leap second” to our clocks, because the earth’s rotation is slowing down a very tiny bit.

## Why?

- A. Earth is cooling and losing energy
- B. Hurricanes are using up earth’s energy
- C. Volcanoes are using up energy
- D. Global warming
- E. Friction of the oceans on the sea floor

**You may talk with the person next to you!**



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20,000 years ago was the last “Ice Age.”



Woolly mammoths and saber-toothed tigers roamed the earth, which had large sheets of ice on it.

How much have ocean levels risen since then?

- A. About a foot or so
- B. About 10 feet
- C. About 50 feet
- D. About 100 feet
- E. About 400 feet

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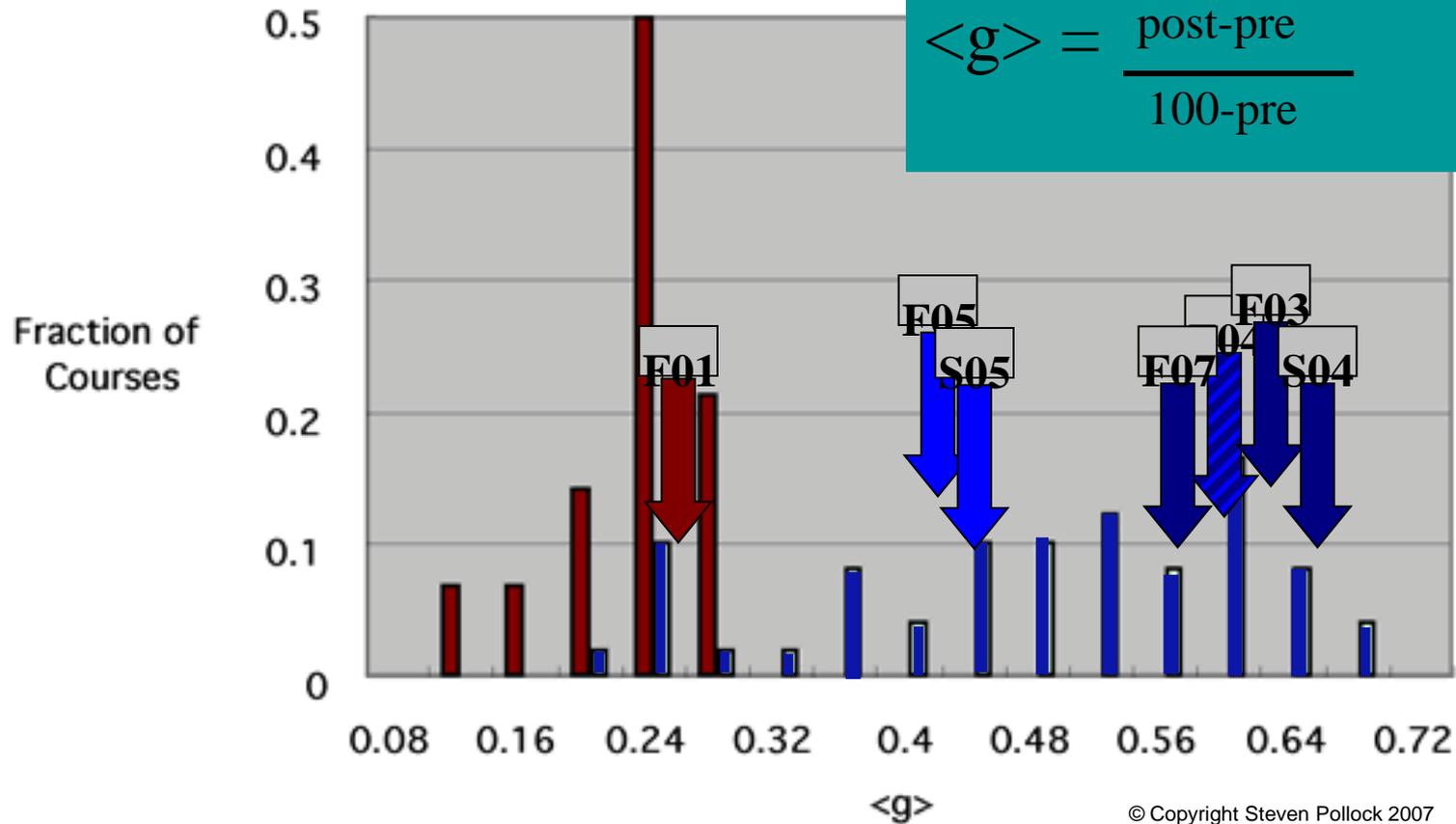
# What difference does interactive engagement make?

Traditional lecture (popular professor)

Clickers

Clickers + tutorials

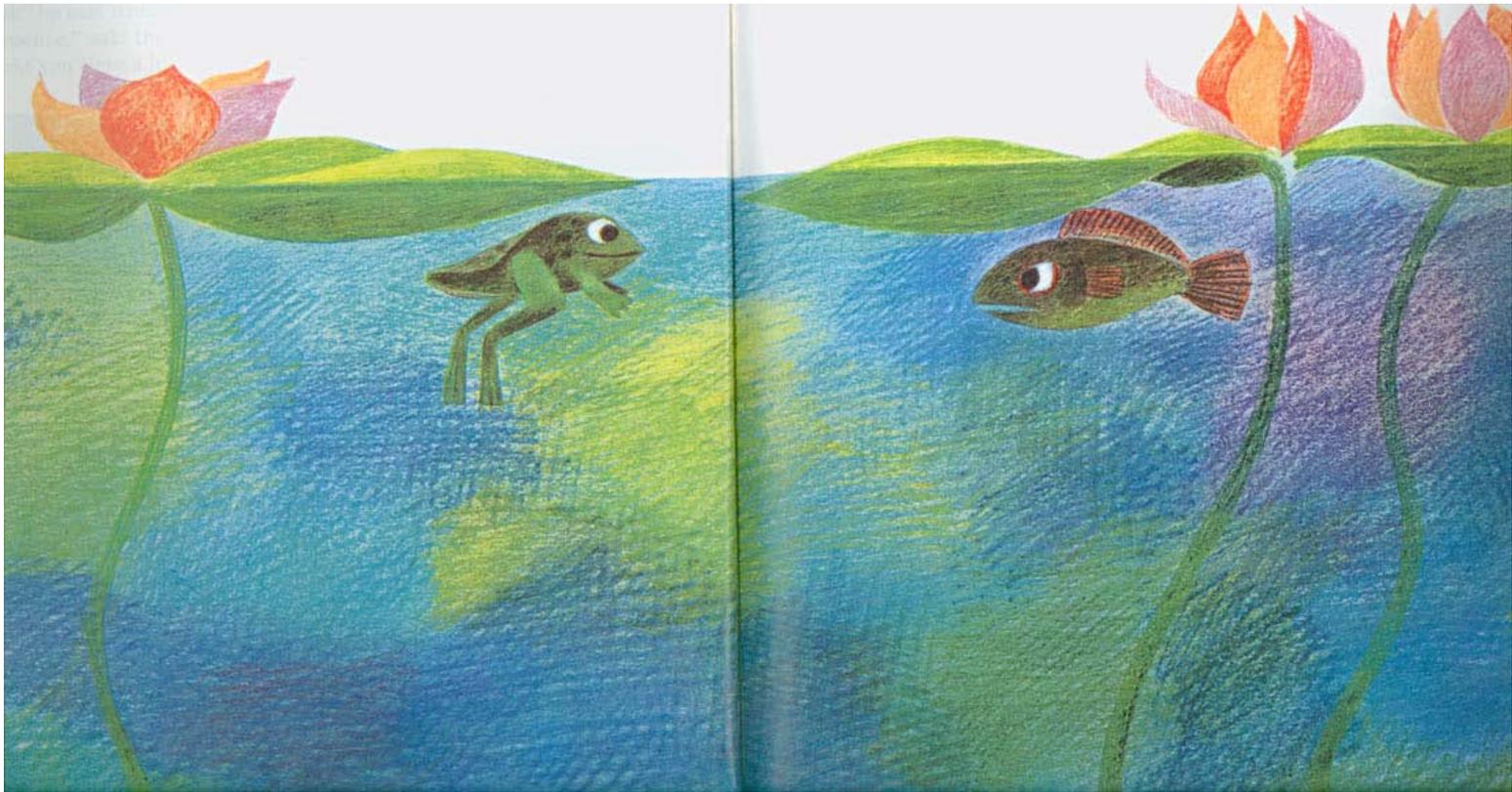
red = traditional, blue = interactive engagement



The graph shows the fraction of *everything taught* students learn *thoroughly* during the semester. Red and blue histogram bars are for 52 classes throughout the US.

***A last advantage...*** discussion reveals' assumptions and arguments, which often are not what you expect.

## **Fish is Fish...**



One of the “fishy friends” is actually a tadpole. He promises that when he can go on land he will report back what he sees. He sees amazing creatures called “birds,” that have wings and feathers and fly through the air. His friend the fish imagines what he’s been told...



And there are animals called “cows,” that have udders and eat grass...



***These are students and visitors!***

Knowing their assumptions is invaluable to good teaching.

# Thank you!

