Curriculum Design: Learning Styles, Active Learning

Curriculum Design: "Backward Design" (10-15 min)

Learning Styles: Metacognition, VARK (10-15 min)

Active Learning: Using clickers as one way to encourage (30 min)

Many good resources available (Check out your own institution's equivalent of a Learning/Teaching Center)

"Scientific Teaching"

Jo Handelsman

Bill Wood

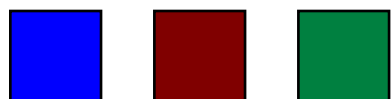*"Handbook on Teaching Undergraduate Science Courses: A Survival Training Manual"*

"Disciplined Based Education Research"

Gordon Uno

Susan Singer

Which of the following represents the average number of hours I (expect to) spend preparing for each 1 hr lecture of a new course?

A. 1-2
B. 2-3
C. 4-6
D. More than 6
E. I haven't a clue

Which of the following represents how I will likely be spending MOST of my prep time for a new course?

A. Relearning the stuff in the textbook well enough that I can explain it
B. Putting together powerpoint slides
C. Putting together an outline or set of notes
D. Crafting learning objectives and determining how I will assess they have been reached
E. Designing in-class activities to help my students achieve learning objectives
F. Other (not listed above)
G. I haven't a clue

Things to consider when designing and teaching your first (or 45th) course

Begin by articulating learning goals/objectives.
Do this for course, unit, individual class meetings →

Decide how you will assess whether learning objectives have been met (pre-/post-tests**, real-time assessment, performance on assignments and exams, lab practicals, writing/papers, oral presentations, rubrics) →

Design lectures, assignments, and activities to meet LOs; design to meet the needs of diversity of students →

Assess whether students are meeting goals →

Figure out what worked and what didn't and try to keep the former and improve the latter.

Learning Objectives

Be explicit and detailed (see handout for some examples)

What are your learning goals for your students?
- Factual knowledge/vocabulary/"content"
- Concepts
- Critical thinking skills
- Improved communication skills
- Methodology
- Access and critically evaluate sources of information

Prioritize and assess (it's not an important learning objective if you don't assess it)

LEARNING OBJECTIVE

Think about HOW you teach as much as WHAT you teach

What's the best way to learn to increase retention?

A. Listen to a lecture (a good one with clear explanations)
B. Read (e.g. textbook, article)
C. Listen and watch an audio-visual presentation
D. Discuss with classmates
E. Practice alone (e.g. applying concept/problem-solving/lab technique); self-test
F. Practice in a group (e.g.applying concepts/problem-solving/lab technique); quiz each other, explain concepts to each other
G. Write a paper, give an oral presentation, or present a poster

What's the best way to learn to increase retention?

TEACH OTHERS

DEPENDS ON THE INDIVIDUAL LEARNER (e.g. MBTI, VARK)

ACTIVE GENERALLY BETTER THAN PASSIVE METHODS

Metacognition: Learning about learning

Pull back the curtain on your teaching strategies.
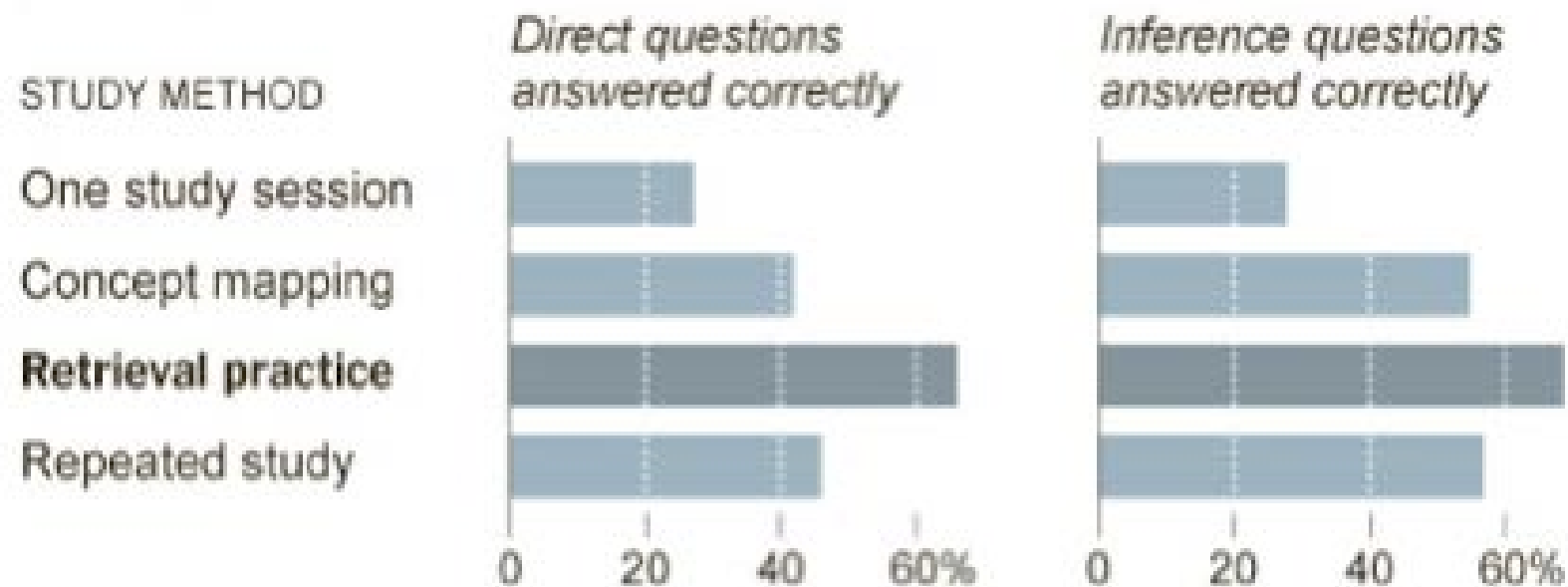
"Test" is not a 4-letter word.

Neither is "quiz" nor "exam".

Learning Through Testing

Researchers asked college students to study a short science text using one of four study methods, then tested them a week later. The most effective study method combined two study sessions with retrieval practice, tests that asked the students to recall what they had read.

STUDY METHOD	Direct questions answered correctly	Inference questions answered correctly
One study session		
Concept mapping		
Retrieval practice		
Repeated study		

0 20 40 60%   0 20 40 60%

Source: Science
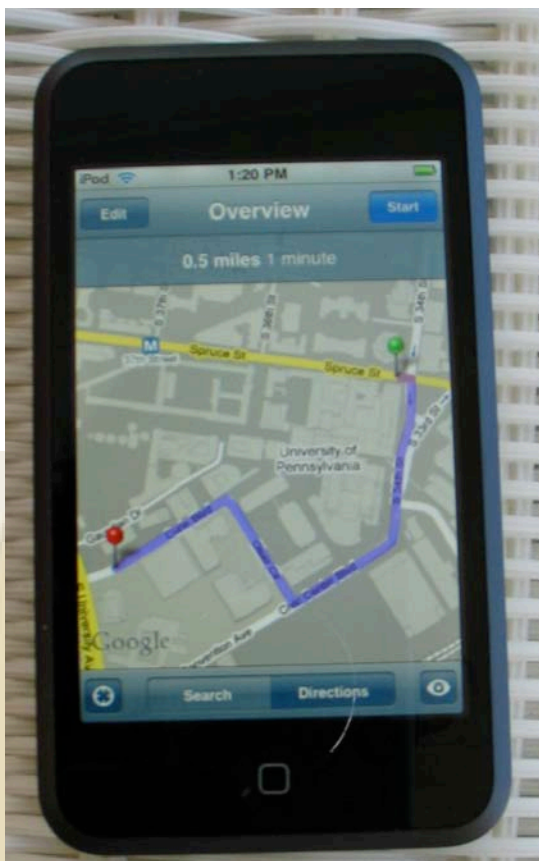
☑ RECOMMEND

Preferred Learning Styles: VARK
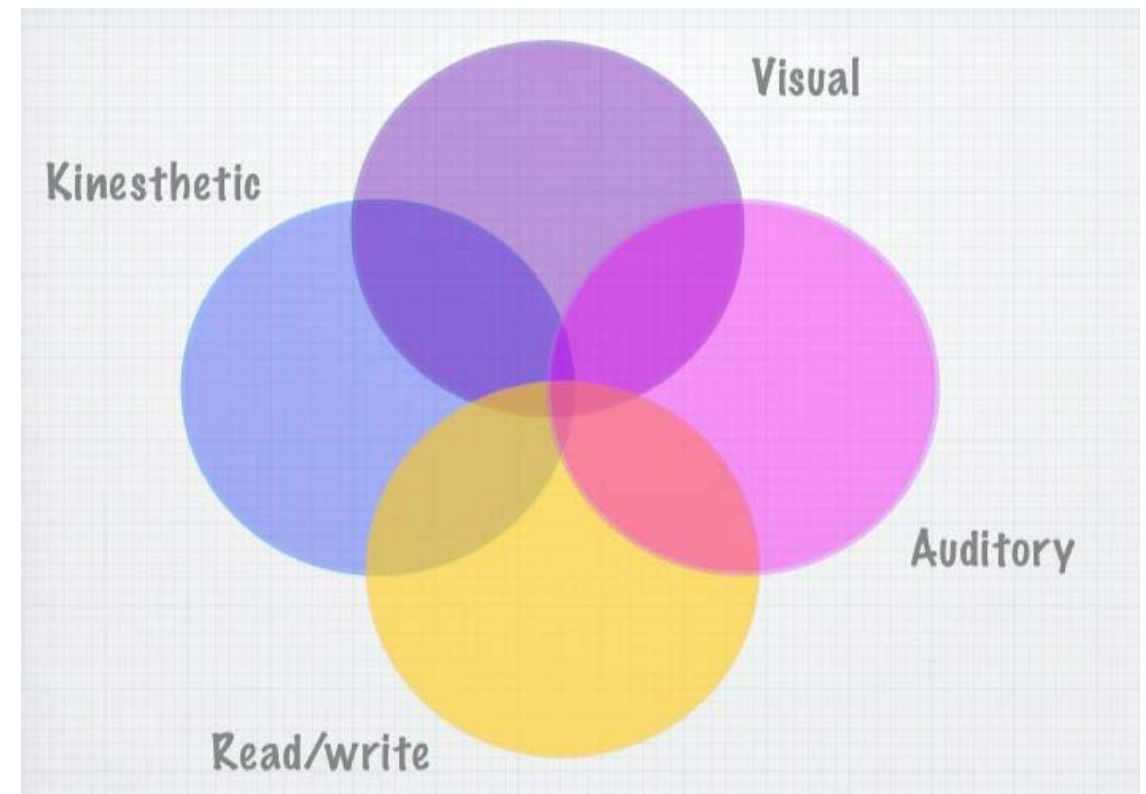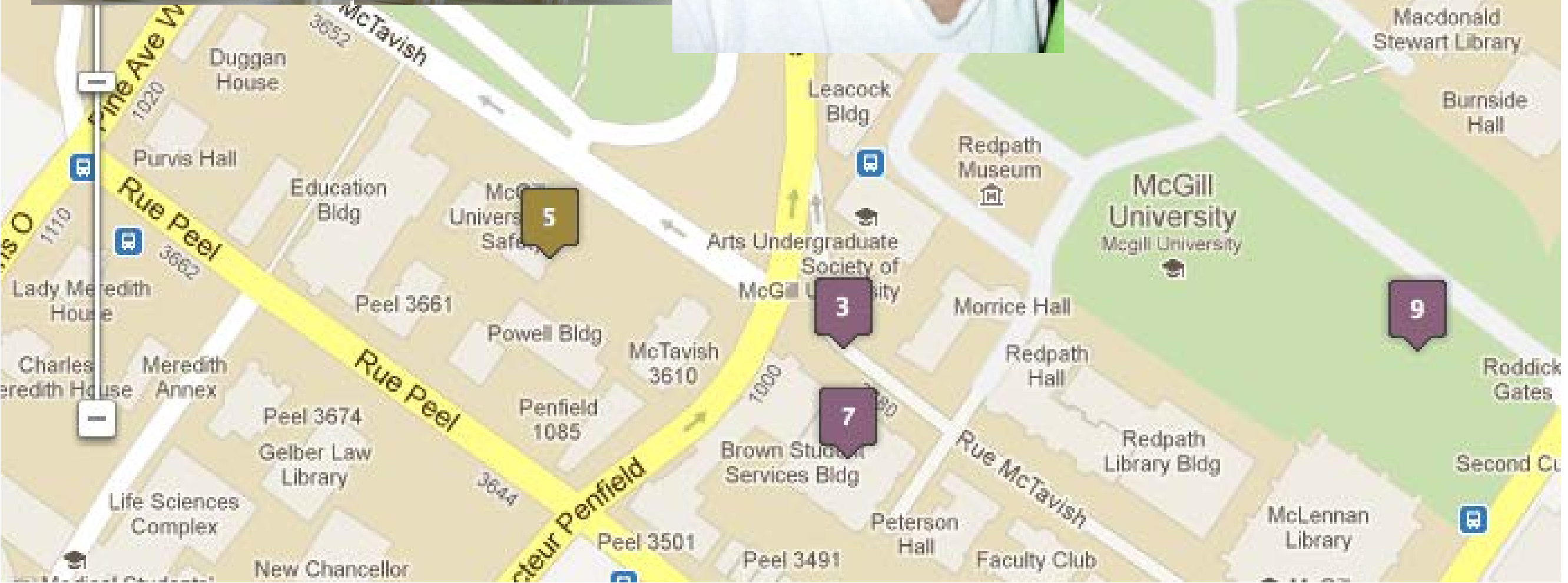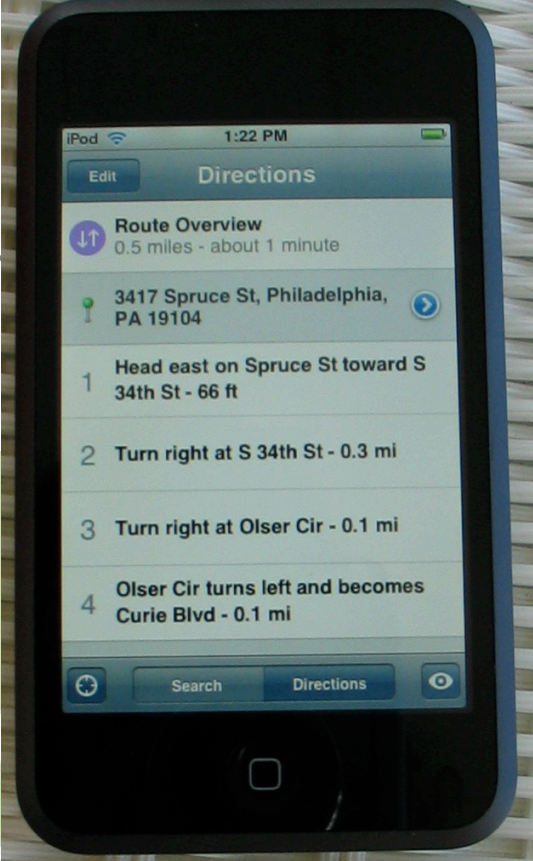
How do you prefer to be given directions to a new place?

(a) Looking and interpreting a map

(b) Reading and following directions

(c) Pulling over and asking for directions

(d) Following someone else who seems like they know where they're going

VARK

Different students will have different preferred modalities for learning; many will be multi-modal; suggest they determine their preferred mode

Present the same information multiple ways, both when introducing material AND when testing/assessing (see handout for examples)

For more, see http://www.vark-learn.com/english/index.asp

Active Learning is avoiding this scenario:

Any ideas?

Rule of Thumb: If primarily lecturing, interrupt yourself every 10-15 minutes with something (anything!) such as a question to the class or short activity or demonstration

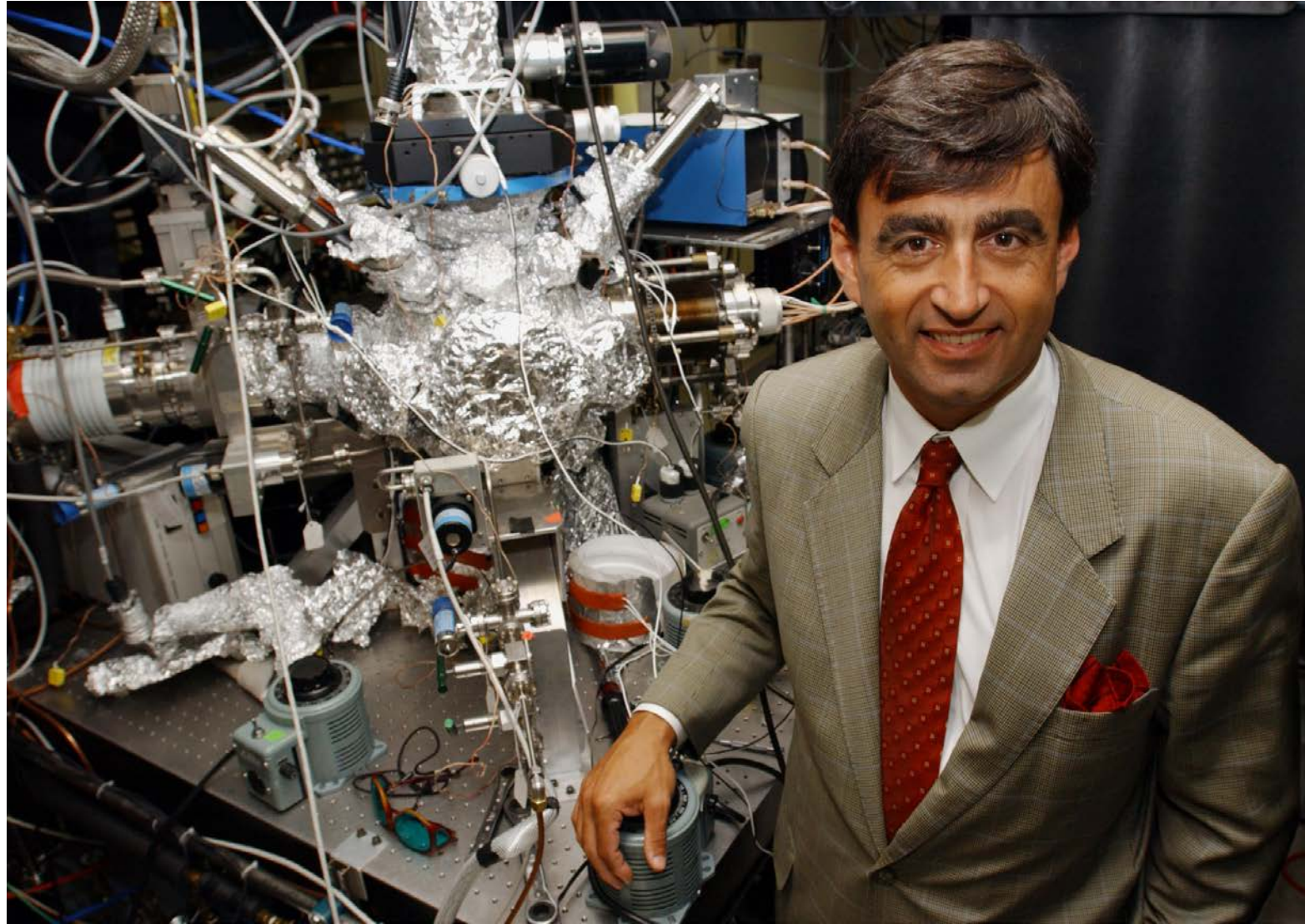# PRS clickers are handheld devices that enable instructors to poll a class and view instant aggregated results.

The use of PRS was pioneered largely in the sphere of undergraduate physics instruction.

Prof. Eric Mazur, Harvard University
(1993)

Possible uses of PRS (Clicker systems)

- Just-in-Time Teaching (Check for/promote understanding)
- Explore pre-existing knowledge/ Pose questions designed to reveal misconceptions
- Anonymous opinion polling: (a) Provide a mechanism for getting honest answers to sensitive questions; (b) Identify values, attitudes, and opinions
- Pose short problem-solving questions (application of concepts)
- Instant roll call
- Get feedback from learners

Bloom's Taxonomy of the Cognitive Domain

1. **Factual knowledge:** remember and recall factual information

2. **Comprehension:** demonstrate understanding of ideas, concepts

3. **Application:** apply comprehension to unfamiliar situations

4. **Analysis:** break down concepts into parts

5. **Synthesis:** transform, combine ideas to create something new

6. **Evaluation:** think critically about and defend a position

Examples (from the course textbook's supporting website) of how to use clickers to waste time…

Alternate forms of a gene are called

a. loci
b. phenotypes
c. alleles
d. genotypes
e. heterozygotes

Examples (from the course textbook's supporting website) of how to use clickers to waste time…

When Mendel crossed two pure pea plants, one with green seeds and one with yellow seeds, the F1 progeny had

a. green seeds
b. yellow seeds
c. some yellow and some green
d. a color in between green and yellow
e. no seeds

This is one of the questions I used for that lecture.

What is the probability that a couple who are both carriers for cystic fibrosis (i.e. CFTR +/-) will produce a child with cystic fibrosis (CFTR -/-)?
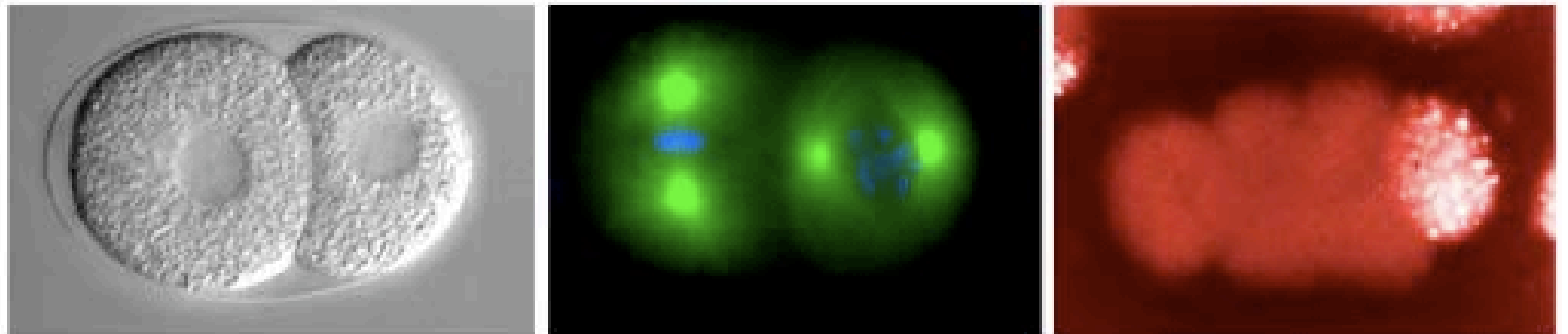
a. 0%
b. 25%
c. 50%
d. 75%
e. 100%

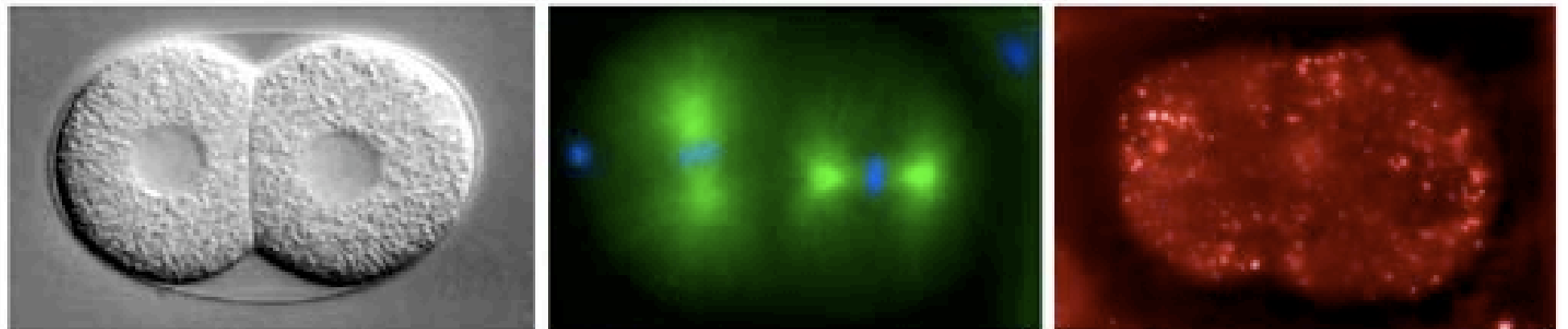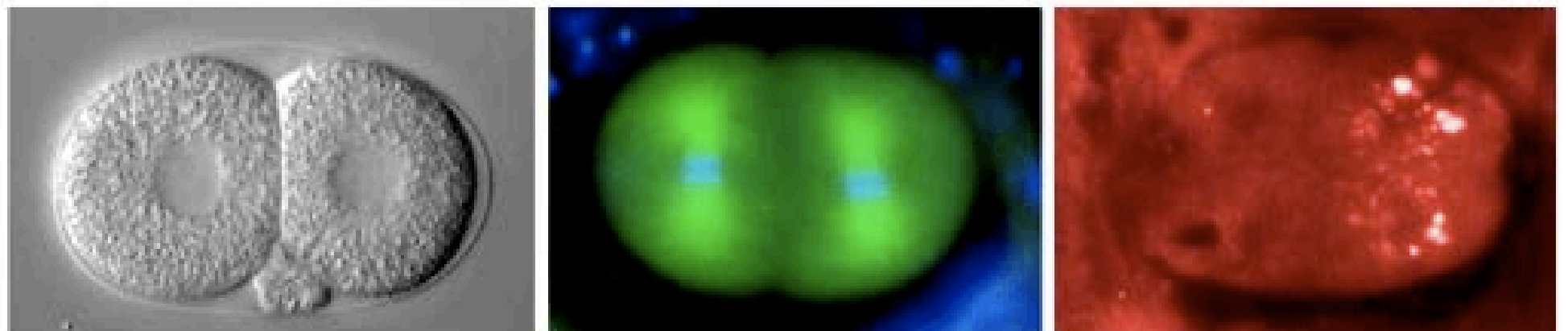# Cover a new concept (e.g. maternal effect alleles)

Ask students a question that applies the concept.

When self-fertilized, worms heterozygous for a recessive maternal effect lethal mutation will produce

(A) all viable offspring
(B) ¼ dead embryos
(C) ¾ dead embryos
(D) all dead embryos

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(A) all viable offspring
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(C) ¾ dead embryos
(D) all dead embryos

Possibly follow up with an additional question to ensure concept is understood.

The homozygous recessive offspring of the previous cross, when mated with a wildtype male, will produce

(A) all viable offspring
(B) ¼ dead embryos
(C) ¾ dead embryos
(D) all dead embryos

A different kind of question to ask.

I worked on the problem set

a. By myself
b. With 1 other person from this class
c. With 2 – 3 other people from this class
d. With 4 or more other people from this class

A different kind of question to ask.

I worked on the problem set

a. By myself **43%**
b. With 1 other person from this class **29%**
c. With 2 – 3 other people from this class **12%**
d. With 4 or more other people from this class **0%**
e. **16%**

Get feedback from students (another example)

Which of the following concepts covered in today's class is the "muddiest" in terms of your understanding and ability to apply?

List concepts A, B, C, D, E…

Identify values, attitudes, and opinions

Example: Have students read NYTimes article "FBI expands DNA database to suspects and minors" and ask whether

(A) I agree strongly with the FBI's new policy.
(B) I agree with the FBI's new policy.
(C) I'm ambivalent.
(D) I disagree with the FBI's new policy.
(E) I disagree strongly with the FBI's new policy.

Use clicker systems effectively to promote learning

1. Integrate questions into teaching flow (e.g. create and embed questions into powerpoint)
2. Avoid overuse of clickers (4-8 questions might be good target)
3. Link questions to learning objectives
4. Anticipate answers and explanations
5. Build in discussion time! (Try strategy of question → peer discussion → question.) Respond to and discuss student responses.
6. Be prepared to alter lecture/class time depending on feedback.

Self-reflective questions for instructors

- Do I accurately know what is difficult for my class?

- How do I know if my students "got" what I just said?

- How nuanced is my day-to-day understanding of where my students' learning is?

- Does every student in my class have a voice?

- Are my students learning from each other?

Looking ahead:
Different PRS technologies and models for adoption

- Clickers (as discussed)
- Desktop computers
- Cell phones
- Combination of the above

- Instructor provides
- Students purchase
- College provides

FINAL WORD

"Fill your mind, and be yourself."

-the incomparable Jan Serie (1952 – 2008)

Write down one new idea or strategy you think you will use to improve how you teach (and thus what and how your students learn).