Preparing and Engaging Students in Large Lectures

David Gerdes
gerdes@umich.edu
Department of Physics

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Misconceptions

- Misconceptions of students
  - I don’t need to understand the material right now. (I’ll study the night before the exam!)
  - I don’t have to prepare for class.
  - I understood the lecture.
- Misconceptions of professors
  - I don’t have time to engage the students (too much material to cover!)
  - I can tell what they know.
  - They prepared for class.
  - They understood the lecture.

Some Active Learning Methods

- Peer Instruction
- Wireless Feedback
- Just-in-Time Teaching
- Online Homework

How to Bring Active Learning to a Large Lecture?

- Make the lecture work for the students
  - Make sure they're prepared to receive the lecture.
  - Alter the lecture: don't just plow through your notes!
  - Reward the students: affect their grade.
- Concentrate on a few main ideas
  - And force the students individually to grapple with them.
- Provide them (and you) with a way to assess how well they're understanding the material.

Interacting with Students: Getting Responses

- Asking individuals doesn't work
  - Same people always volunteer.
  - Other students tune out.
  - Students know how to "wait it out."
- You want <u>everyone</u> to respond.
  - Can't individually poll.
  - Don't want herd voting.
  - Need collective, private, possibly anonymous voting.
- Some methods
  - Low tech: holding up fingers or colored index cards.
  - High tech: electronic response systems.

Response System Functionality

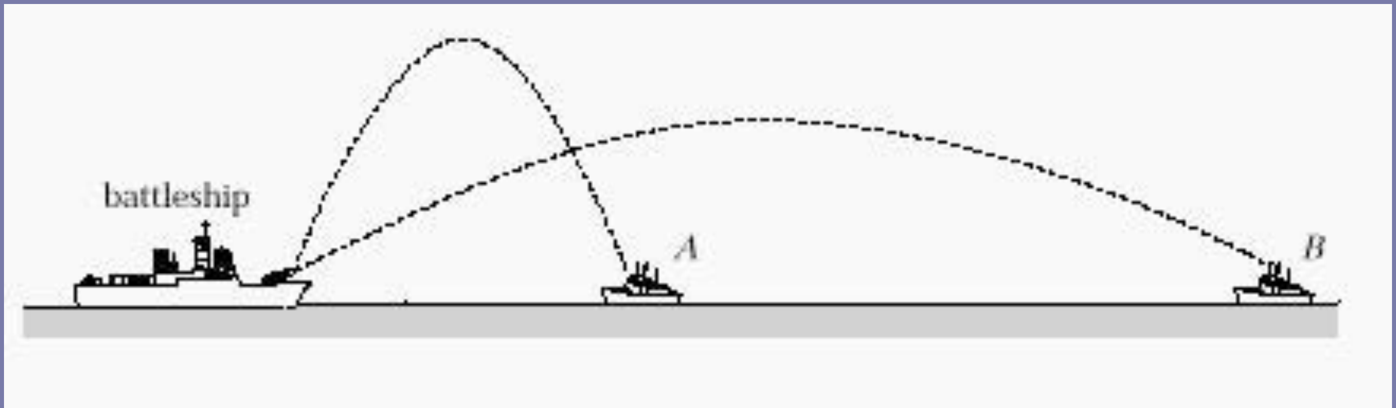
- Individual units for each student.
- Can run in anonymous or known mode.
- Instant statistics on student responses through instructor display tool.
- Can use prepared questions or impromptus.

Model for Student Interactions: ConcepTests and Peer Instruction

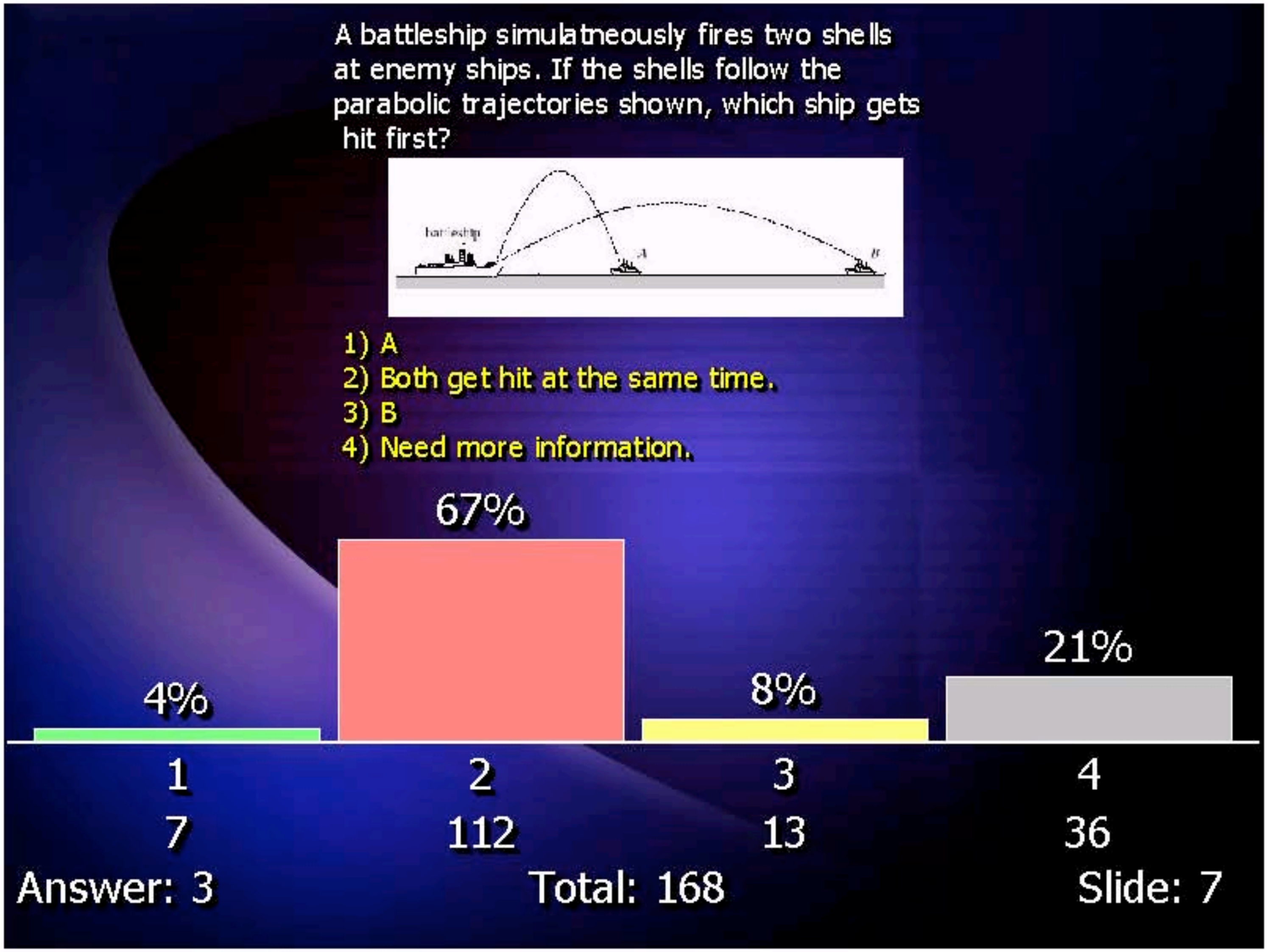
1. Question posed 0.5 min
2. Time to think individually 1 min
3. First responses
4. Peer instruction 1-2 min
5. Revised responses
6. Instructor explanation 1-3 min

An Example ConcepTest

A battleship simultaneously fires two shells at enemy ships. If the shells follow the parabolic trajectories shown, which ship gets hit first?



1) A
2) Both at the same time
3) B
4) Need more information


A battleship simulatneously fires two shells at enemy ships. If the shells follow the parabolic trajectories shown, which ship gets hit first?
battleship
A
B
1) A
2) Both get hit at the same time.
3) B
4) Need more information.
67%
4%
8%
21%
1
2
3
4
7
112
13
36
Answer: 3
Total: 168
Slide: 7

Getting Students to Participate "Aggressively"

- Make it fun
- Make it interesting
- Make them feel that they are really learning (because they are!)
- Give them a chance to get the answers right.
- Don't make it too easy.
- Reward them with a grade.

Benefits of CT/PI approach

- Students come to class! (Attendance ~ 95%)
- Lectures are structured, with “punctuation”
- Students wake up (literally and figuratively) at least 3-4 times a lecture.
- Allows clear emphasis of important points.
- Peer instruction is ego-driven.
- You get immediate feedback (sometimes to your shock and horror).
- Encourages students to learn, rather than to be taught.
- Students often learn better from each other than they do from you, the expert professor.

Peer Instruction is Officially a Trend

- *New York Times*, 4/29/2004
- Although some skeptics dismiss the devices as novelties more suited to a TV game show than a lecture hall, educators who use them say their classrooms come alive as never before. Shy students have no choice but to participate, the instructors say, and the know-it-alls lose their monopoly on the classroom dialogue.
- Professor Caron has become something of a hero among his students. "I won the teacher-of-the-year award," he said,"and it had to be the technology, because I'm not that good. I've been teaching 13 years and never won it, then I'm using this thing and I'm Mister Popularity."

What is your major concern?

1) Takes too much time
2) Students will steal equipment
3) Students won't interact: no peer instruction
4) Writing good questions is difficult
5) Appropriate explanation after conceptest
6) Passing and collecting boxes too complex
7) Too much technology during lecture
8) Technology will fail during lecture
9) Peer instruction doesn't improve learning
10) I'm not comfortable lecturing in this format

Some valid concerns

- Takes time away from lecture.
  - You do need to modify your approach.
  - Cover a bit less material in class.
  - But students will learn/retain more.
- Writing good questions is difficult.
  - Many class-tested questions available.
  - Should rely on the concept being introduced/discussed.
  - Strive for a 60-70% initial correct response rate.
  - You’ll get the hang of it.

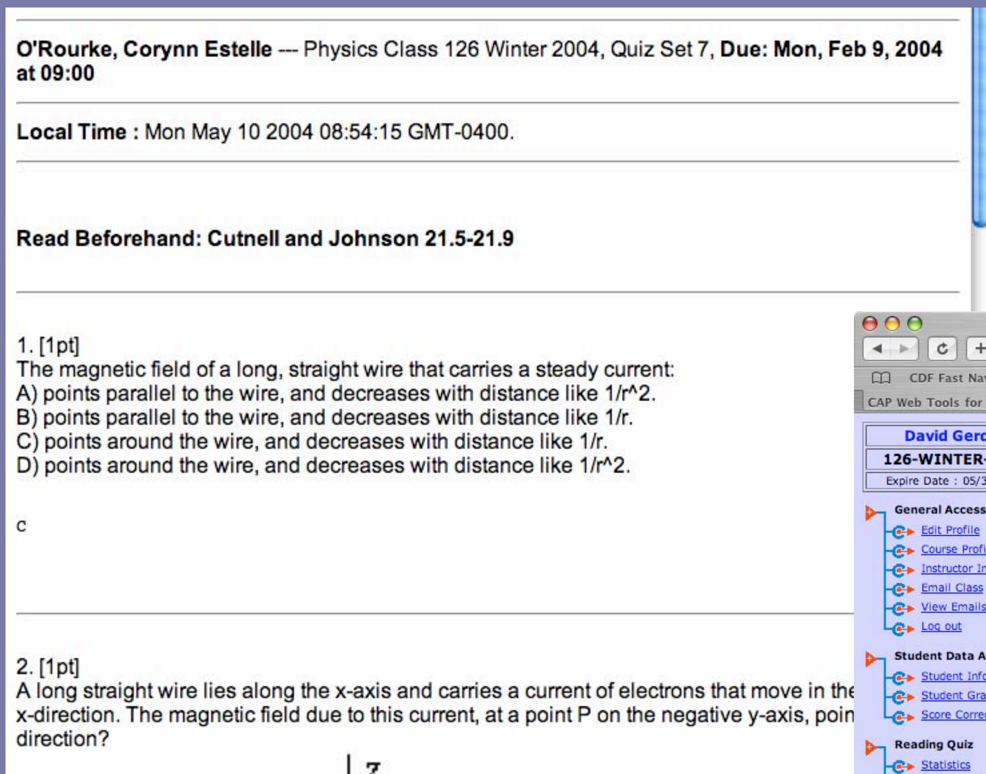
Providing an Explanation

- Don't just repeat yourself.
- Use the incorrect answers to guide you.
- Very helpful to combine the question with a demonstration.
  - Explain the setup.
  - Ask "what will happen when…"
  - Peer Instruction
  - Do the experiment.

Coming to Class Prepared: Preflights

- The problem: Students don’t read the book
  - Because they think that your job in lecture is to explain it to them.
- But the purpose of lecture should be to elaborate on particularly difficult points and develop further understanding.
- Solution: “Just-in-Time Teaching” using web-based reading quizzes.
  - Due ~1 hour before class.
  - Covers material to be discussed that day.
  - Again, a (small) part of their grade.

Example Preflight



O'Rourke, Corynn Estelle --- Physics Class 126 Winter 2004, Quiz Set 7, **Due: Mon, Feb 9, 2004 at 09:00**

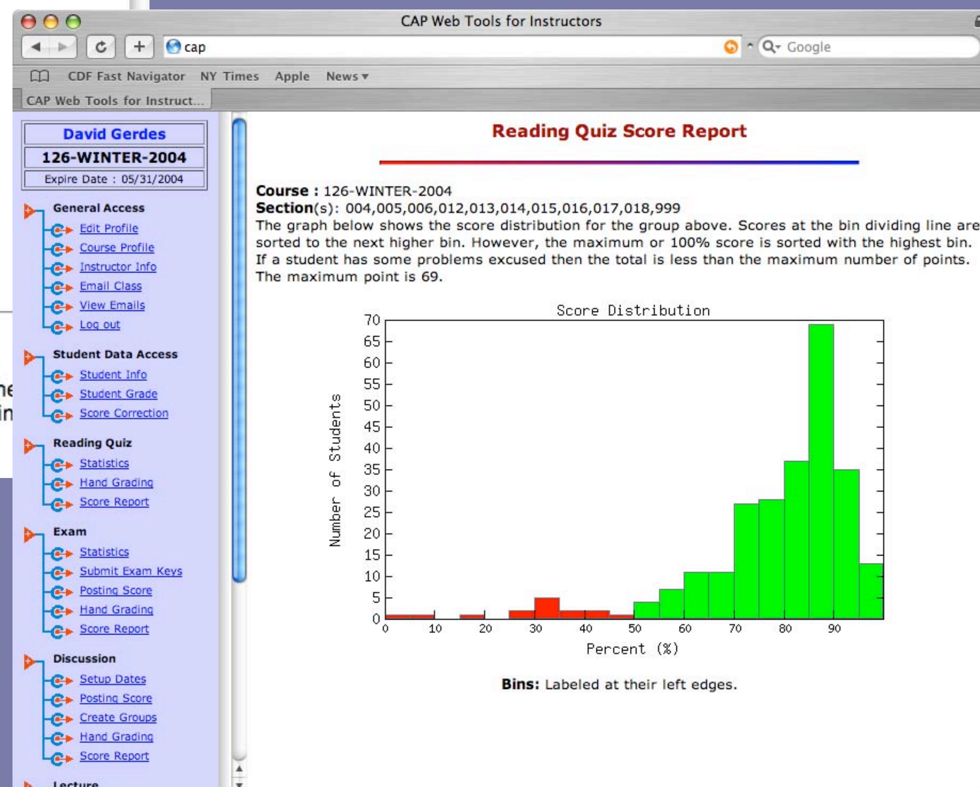
Local Time : Mon May 10 2004 08:54:15 GMT-0400.

Read Beforehand: Cutnell and Johnson 21.5-21.9

1. [1pt]
The magnetic field of a long, straight wire that carries a steady current:
A) points parallel to the wire, and decreases with distance like 1/r^2.
B) points parallel to the wire, and decreases with distance like 1/r.
C) points around the wire, and decreases with distance like 1/r.
D) points around the wire, and decreases with distance like 1/r^2.

c

2. [1pt]
A long straight wire lies along the x-axis and carries a current of electrons that move in the
x-direction. The magnetic field due to this current, at a point P on the negative y-axis, poin
direction?

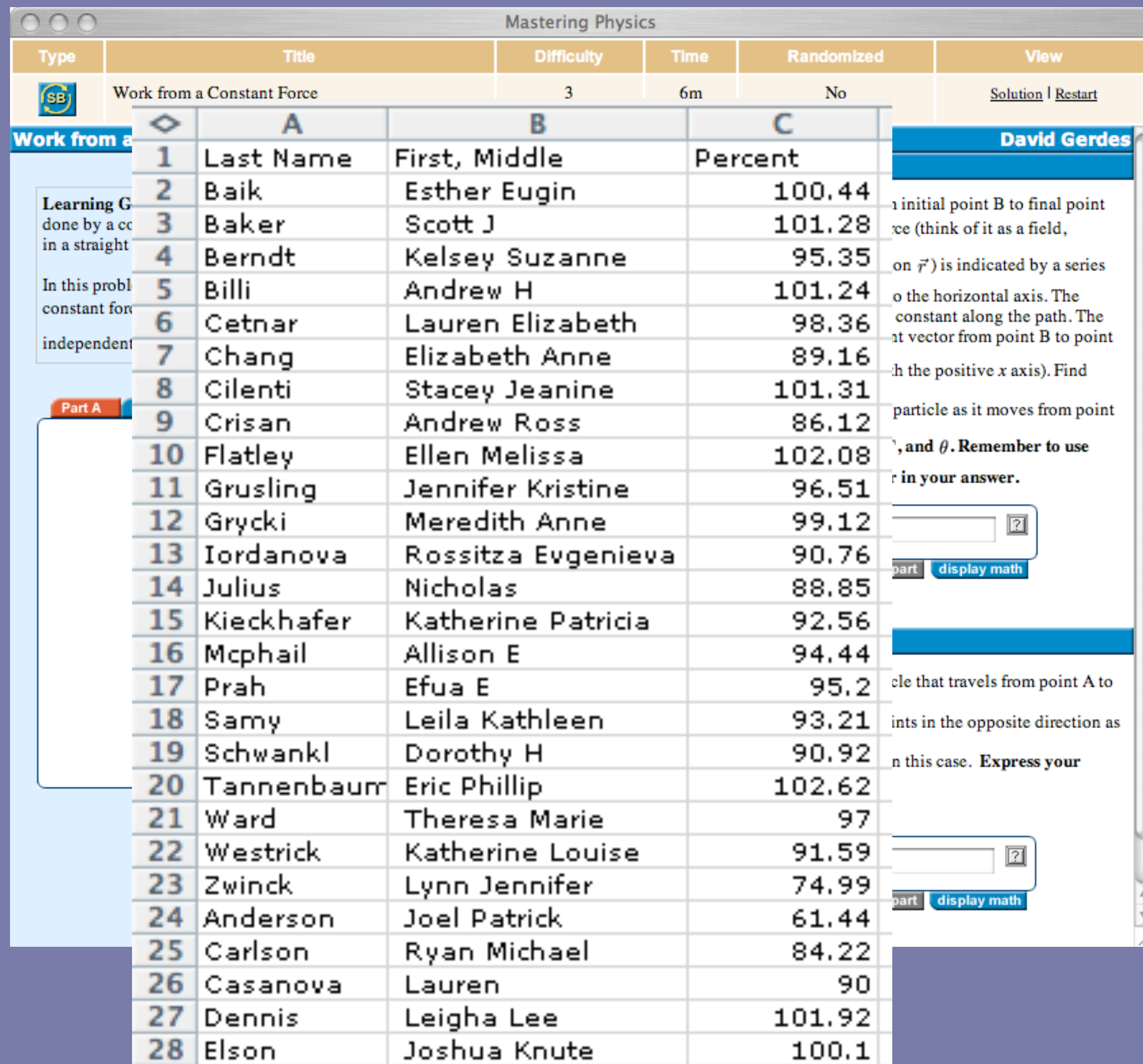


Learning Outside of Lecture

- Where most learning should take place.
- Homework is used to facilitate this.
- Old way: one best effort, minimal feedback, often no grading.
- New way: online homework systems
  - Individualized assignments
  - Instant feedback
  - Students work until they get it right.
  - Extremely detailed automatic grading.

Example: MasteringPhysics

- Students log in and receive individualized homework
- Work problems, get feedback and error-specific hints
- Multiple tries allowed: Incentive of *full credit* is very powerful!
- Students work very hard on this.
- Make it matter: exam problems must reflect content/style of homework.



◇	A	B	C
1	Last Name	First, Middle	Percent
2	Baik	Esther Eugin	100.44
3	Baker	Scott J	101.28
4	Berndt	Kelsey Suzanne	95.35
5	Billi	Andrew H	101.24
6	Cetnar	Lauren Elizabeth	98.36
7	Chang	Elizabeth Anne	89.16
8	Cilenti	Stacey Jeanine	101.31
9	Crisan	Andrew Ross	86.12
10	Flatley	Ellen Melissa	102.08
11	Grusling	Jennifer Kristine	96.51
12	Grycki	Meredith Anne	99.12
13	Iordanova	Rossitza Evgenieva	90.76
14	Julius	Nicholas	88.85
15	Kieckhafer	Katherine Patricia	92.56
16	Mcphail	Allison E	94.44
17	Prah	Efua E	95.2
18	Samy	Leila Kathleen	93.21
19	Schwankl	Dorothy H	90.92
20	Tannenbaum	Eric Phillip	102.62
21	Ward	Theresa Marie	97
22	Westrick	Katherine Louise	91.59
23	Zwinck	Lynn Jennifer	74.99
24	Anderson	Joel Patrick	61.44
25	Carlson	Ryan Michael	84.22
26	Casanova	Lauren	90
27	Dennis	Leigha Lee	101.92
28	Elson	Joshua Knute	100.1

Summary

- Large lecture classes are important and often inevitable, but present special challenges.
- We want to help students do what they need to do to learn.
- We want to assess how students are doing before, during, and after class.
- Interactive and online tools can help with this process.