Large lectures

universally loathed by students and faculty alike

(but here to stay!)
Large lectures

focus on delivery of information
Large lectures

not delivery of information

but assimilation of knowledge
Large lectures

instructor: busy delivering information
Large lectures

instructor: busy delivering information

students: busy taking down information
Large lectures

instructor: can’t address individual student needs

students: no time to think
Technology

not a magic bullet
new method for delivering old content
Interactive Learning Toolkit

Use technology to

• facilitate new modes of learning
• increase interaction
• help instructor address student needs
The Interactive Learning Toolkit helps you implement innovative teaching ideas, such as Peer Instruction and Just-in-Time Teaching, and to monitor your students’ learning. Our goal is to help you focus on teaching by streamlining the organizational work that accompanies the teaching of a course. Select materials for class use from a large class-tested database and organize (and possibly share) your own materials. Administer your courses, design course Web pages, and interact with your students online.

Access to the site is restricted to registered users; if you are not registered, please register now.

This site is supported by a grant from the National Science Foundation and by the Division of Engineering and Applied Sciences at Harvard University.
Outline

- preparing for class
- provoking thought
- additional tools
Preparing for class
Preparing for class

nameless faces
Preparing for class

nameless faces

faceless names
Preparing for class

how to move

information transfer

out of classroom?
Preparing for class

Just-In-Time Teaching: Blending Active Learning with Web Technology

Gregor M. Novak
Evelyn T. Patterson
Andrew D. Gavrin
Wolfgang Christian
Preparing for class

web-based pre-class assignment
Preparing for class

Courses > Physics 1b > Reading > Changing magnetic fields II

Please tell us briefly what single point of the reading you found most difficult or confusing. If you did not find any part of it difficult or confusing, please tell us what parts you found most interesting.

See notebook for an overview of common difficulties.

Click name to respond

Flag similarities closer than: 60 90
1 - 100 of 153 answers

Total of 7 responses sent to students for this assignment

<table>
<thead>
<tr>
<th>Student</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viay Gnaash</td>
<td>The derivation of equations for magnetic energy was tricky (33.6). What is the conceptual meaning of &quot;dφ&quot; in the equations 33.30-33.31?</td>
</tr>
<tr>
<td>Jhon Yung</td>
<td>In section 33.7, it talks about how inductance. I'm still baffled as to exactly what inductance is. I understand that it is the constant of proportionality between the emf and the rate of change of current, but what is the practical application of knowing something like this?</td>
</tr>
<tr>
<td>Chi - Jsiin Tasy</td>
<td>The text relates different ways of calculating induced emf, and finds that Faraday's Law tells us that the induced current produces a magnetic flux to counteract increases in flux through loops. Such applications have been used in toroidal coils. Have there been any other tested shapes of materials and technology that might better and more efficiently use the fundamentals of the law?</td>
</tr>
<tr>
<td>Mici Artoj</td>
<td>I did not find any part confusing. I found the concept of inductance to be most interesting because it provides yet another parallel between electrodynamics and magnetism.</td>
</tr>
<tr>
<td>Kroi Susear</td>
<td>Underneath equation 33.14 there is a note in parenthesis that says that the induced field is NOT an electrostatic field, and so the quantity calculated above is NOT electrostatic work. I understand that the field is different from a normal electric field since it's not created by discreet points.</td>
</tr>
</tbody>
</table>
Preparing for class

Benefits:

• prepares students for class
• helps instructor address individual student needs
• increases student-faculty interaction
• connects names and faces
Outline

• preparing for class
• provoking thought
• additional tools
What to do in class?
Provoking thought
Provoking thought

Focus on depth, not breadth
Provoking thought
Some hurdles:

- finding materials
- collecting and managing feedback
- providing materials to students
Provoking thought

1. A permanent magnet is dropped through a long aluminum tube, as shown. As the magnet drops, electric currents are induced around the tube. Compared to a freely-falling magnet, the magnet through the tube drops:

   1. more slowly,
   2. exactly the same way,
   3. faster,
   4. Need more information.

Note: consider the effects of induced currents through strips ahead of and behind the dropped magnet.

Answer: In a loop of the aluminum tube just below the magnet, the flux is increasing as the magnet gets nearer. This induces a counterclockwise current producing an opposing magnetic field which repels the magnet. In a loop above the magnet, the flux is decreasing, so a clockwise current is induced, producing a magnetic field in the same direction as the magnet's field, thus attracting the magnet inward. So the net effect is to slow the magnet down.

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2. Consider the arrangement shown below. Conducting rod AB is lying on a U-shaped conductor, making good electrical contact. The arrangement is placed in a magnetic field (into page).
Provoking thought

Benefits:

• easy preparation

• automatic student Web page generation

• management of data
Outline

• preparing for class
• provoking thought
• additional tools
Additional tools

- forums
- e-mail
- gradebook
- cloning
- reminders

and much more!
Additional tools

Interactive Learning Toolkit is:

- a learning management system
- a content management system
- a course management system
Additional tools

Resources:

ILT video (www.ankerpub.com)

Books on PI and JiTT (Prentice Hall)

ILT site: deas.harvard.edu/ilt
Summary

• enables new modes of learning
• helps instructor address student needs
• facilitates workflow
Students’ conclusion:

“Prof. Mazur is not teaching us anything. We have to learn it all ourselves.”
Impact and Assessment

Interactive Learning Toolkit

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Impact and Assessment

- ILT helps assess performance
- active learning result
Impact and Assessment

- easy to administer
- easy to implement
- easy results!
Impact and Assessment

Available assessment instruments

- Force Concept Inventory
- Conceptual Survey on Electricity and Magnetism
- Lawson’s test for scientific reasoning
- Astronomy Diagnostic Test
- Maryland Physics Expectation Test

over 15,000 students tested!
Impact and Assessment

Force Concept Inventory

Use the statement and figure below to answer the next two questions (15 and 16).

A large truck breaks down out on the road and receives a push back into town by a small compact car as shown in the figure below.

• Conceptual test of Newtonian Mechanics
• Pre/Post testing gives learning gain
• 30 questions

Hestenes et al., 1992
A ball is fired by a cannon from the top of a cliff as shown above. Which of the paths would the cannon ball most closely follow?
Impact and Assessment

FCI results for standard lecture courses

\[ g = \frac{S_f - S_i}{1 - S_i} \]

FCI results for ‘active learning’ courses

\[ g = \frac{S_f - S_i}{1 - S_i} \]
Impact and Assessment

Impact on one of our courses

![Bar chart showing score distribution]

1991 FCI pretest
Impact and Assessment

Impact on one of our courses

![Bar chart showing FCI posttest scores](chart.png)
Impact and Assessment

Impact of active learning on gender gap

![Bar chart showing average score (%)](chart.png)
Impact and Assessment

Impact of active learning on gender gap

![Bar chart showing average scores for women and men across different conditions: T, IE, IE+](chart.png)
Impact of active learning on gender gap
Impact and Assessment

ILT provides:

• access to standardized assessment

• technology to implement active learning

Impact of active engagement on student learning:

• gains for all students

• eliminates gender gap
Scaling-up
Scaling-up

dramatic growth in PI adoption…
Scaling-up across the world...
Scaling-up across disciplines...

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>82%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4%</td>
</tr>
<tr>
<td>Life Sciences</td>
<td>4%</td>
</tr>
<tr>
<td>Engineering</td>
<td>3%</td>
</tr>
<tr>
<td>Astronomy</td>
<td>2%</td>
</tr>
<tr>
<td>Mathematics</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
</tbody>
</table>
Scaling-up and across institution type

- University: 67%
- 4-yr college: 19%
- High school: 5%
- 2-yr college: 3%
- Comm. college: 3%
- Other: 3%
Scaling-up

plenty of potential to scale up
Scaling-up

current ILT user base

Faculty (active)    70
Students           7000
Courses (active)   400
Future development
Future development

- let system help manage discussions
- improve content and content-management
- link to existing course management systems