

The LearningOnline Network with Computer- Assisted Personalized Approach (LON-CAPA)

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Michigan State University



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LON-CAPA

What is
LON-CAPA?



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LON-CAPA

- Learning Content Management System
- Assessment System
- Open-Source and Free



LON-CAPA

- Learning Content Management System
- Assessment System
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LCMS

- Providing high quality learning content in an online environment is time and cost intensive
- Typical scenario today:
 - Online material is developed by only one instructor
 - Online material is used by only one instructor
 - Online material is used in only one course
 - No assessment of learning effectiveness
 - In-effective use of time and resources

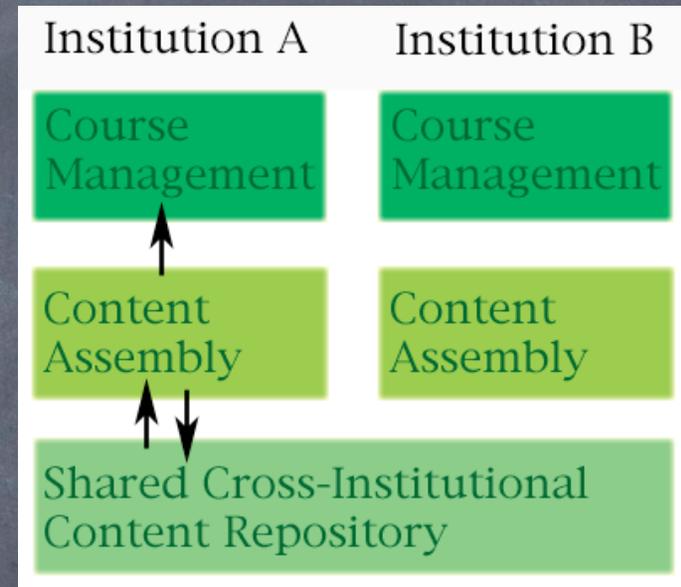


LCMS

- Much better scenario:
- Online material is developed and reviewed by more than one instructor
- Online material is shared among instructors
- Online material gets used across many courses and disciplines
- Continual assessment of learning effectiveness

LearningOnline Network

- LON-CAPA learning content management is:
 - a cross-institutional cross-disciplinary content repository
 - a tool to seamlessly assemble this content
 - a complete course management system to readily deploy this content



Bottom: Virtual Filesystem

"The aisles of your
supermarket"



Domain - sc (University of South Carolina)
Domain - sfu (Simon Fraser University)
batchelo
chem281
exafs
hanlan
mxchen
slavieri
vjungic
Domain - sunysb (SUNY Stony Brook)
Domain - tmcc (Truckee Meadows Community College)
jensen
mbauer
souza
Greenberg
default.sequence (metadata)
samples
testuser1
Domain - ucf (University of Central Florida)



LearningOnline Network

Impedance

The addition of the three currents (through the resistor, the inductance, and the capacitance), each of which is 90° out of phase with each other, in quadrature yields:

$$\begin{aligned} V &= \sqrt{V_R^2 + (V_C - V_L)^2} \\ &= \sqrt{(IR)^2 + (IX_C - IX_L)^2} \\ &= I\sqrt{R^2 + (X_C - X_L)^2} \\ &= IZ \end{aligned}$$

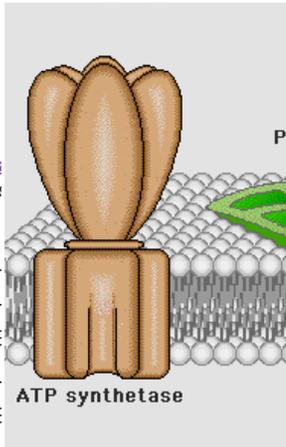
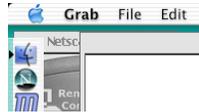
where I is the current, X_C and X_L are the **capacitive** and **inductive** reactances, respectively, and Z is obtained for Z:

$$\begin{aligned} Z &= \frac{V}{I} \\ &= \sqrt{R^2 + (X_C - X_L)^2} \\ &= \sqrt{R^2 + (X_C - X_L)^2} \end{aligned}$$

Z is dependent on the frequency and has its m

the frequency of oscillation of the pure LC circuit, the frequency dependence of the impedance and c

In summary, reactances in series have to be added to find the total impedance, which is the AC equivalent of the



Thylakoid Lumen



Animation speed:

- faster
- medium
- slower

Play animation number:

1 2 3 4 5 6 7 8 9



Integrated Scientific Typesetting

Combined
HTML/
LaTeX
Source

```
<html>
<head>
<title>A Math Equation</title>
</head>
<body bgcolor="#FFFFFF">
The function is
<m> \[f(T)=\frac{1}{\omega}\int_{0}^{T}dt\frac{1}{t^2}\] </m>
where <m> $\omega$ </m> is the frequency, and <m> $T$ </m> is the period.
</body>
</html>
```

Configurable online rendering:

As HTML

As Image

Using Mathtype fonts

Compatible

Compatible

Configuration

Low bandwidth

high bandwidth

Low bandwidth

The function is

$$f(T) = \frac{1}{\omega} \int_0^T dt \frac{1}{t^2}$$

where ω is the frequency, and T is the period.

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</body>
</html>
```

Print:
HTML→LaTeX
PDF output

The function is

$$f(T) = \frac{1}{\omega} \int_0^T dt \frac{1}{t^2}$$

where ω is the frequency, and T is the period.



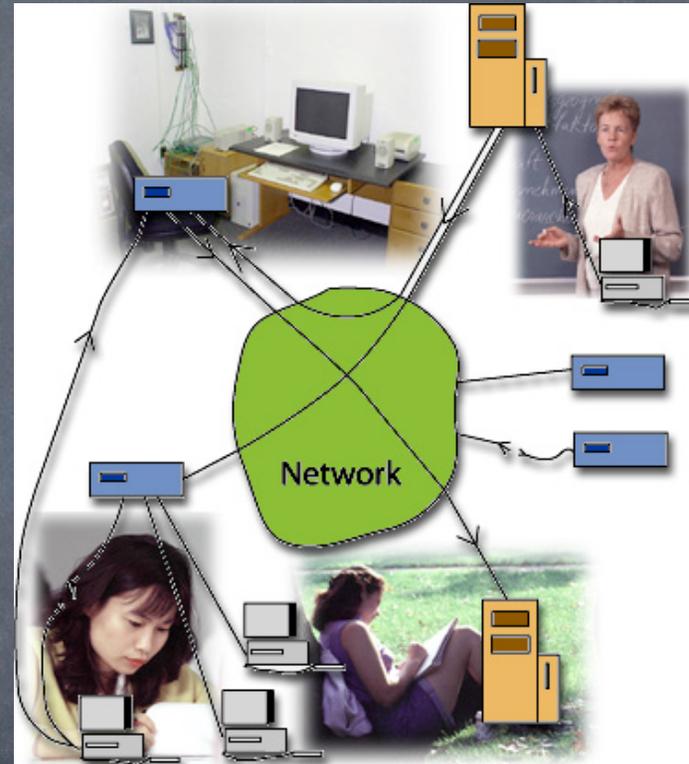
Licensing

- Authors keep copyright and ownership
- Authors grant right of use
- Authors determine who can use their content and how
- Users cannot modify source
- Configurable so that users cannot even see source



Network

- Network of connected servers
- Any server in the network can serve any resource in the system
- Content replication in background
- Network-wide persistent URL paths



<http://neptune.physics.ndsu.nodak.edu/res/msu/mmp/kap18/problems/cd>

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Replication



<http://neptune.physics.ndsu.nodak.edu/res/msu/mmp/kap18/problems/cd>

- North Dakota State University server serving resource from Michigan State University
- First time the resource is accessed, it is copied in the background
 - closer to user
 - MSU not stuck with serving the resource
 - will continue to work if connection to MSU down
- Leaves behind subscription on MSU server
- When resource updated at MSU, NDSU copy is either updated or deleted, depending on usage pattern



Bottom: Virtual Filesystem

- Currently links 3 middle schools, 18 high schools, 4 community colleges, and 24 universities
- 20,900 content pages
- 18,600 homework and exam problems
- 12,500 images
- 2,100 content assemblies
- 1,100 simulations and animations
- 500 movies
- Publisher libraries, “back of the chapter problems”



Bottom: Virtual Filesystem

- Static metadata: Dublin Core, cross-walk to IMS
- Dynamic metadata: use assembly data for recommender system:

Access and Usage Statistics

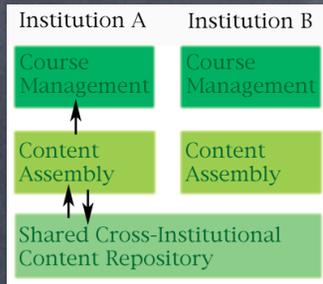
Network-wide number of accesses (hits)	890
Number of resources using or importing resource	1 <ul style="list-style-type: none"> • Eukaryotic Gene Control [msu/bio/Gene_Expr/111f03GeneCntrl.sequence]
Number of resources that lead up to this resource in maps	1 <ul style="list-style-type: none"> • Back to the Original Question [msu/bio/Gene_Expr/problems/originalquestion.problem]
Number of resources that follow this resource in maps	1 <ul style="list-style-type: none"> • Eukaryotic vs Prokaryotic Gene Expression II [msu/bio/Gene_Expr/problems/eukvsprokII.problem]
Network-wide number of courses using resource	3 <ul style="list-style-type: none"> • LBS 145 - Spring 2004 • ZOL 341 - Fall 2003 • BS 111 - Fall 2003

Assessment Statistical Data

Total number of students who have worked on this problem	291
Average number of tries till solved	1.37
Degree of difficulty	 (0.36)



Middle: Resource Assembly Tool



Toggle Display Mode Zoom Out Zoom In
Condense Straighten Revert Undo Redo Store

Start

Res

Cond

Res

Res

Link

edit

From Physical Units Refresher to Physical Units Test

[Delete Link](#)

[Insert Resource Into Link](#)

[Done](#)



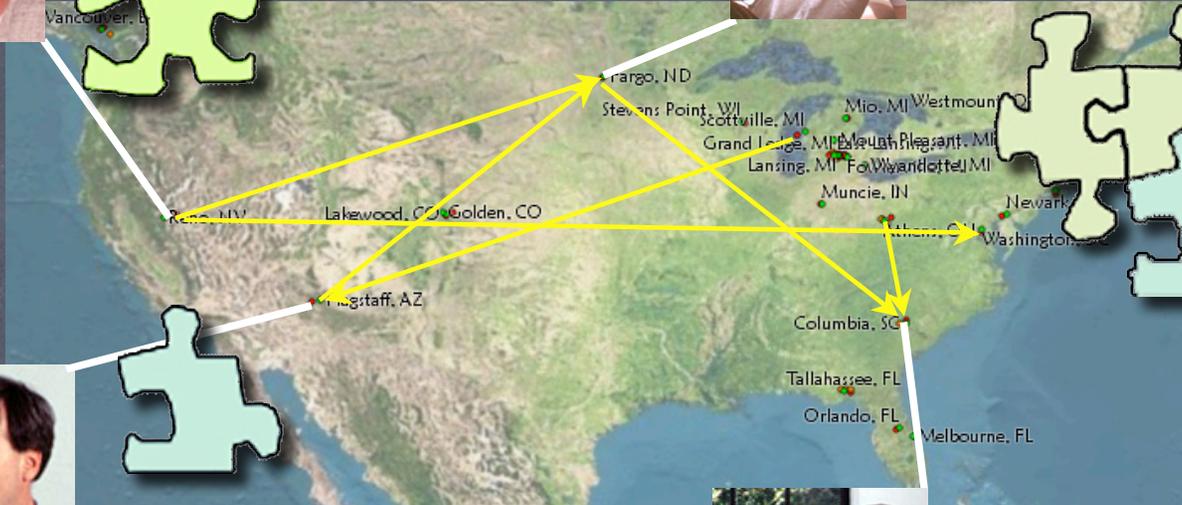
LearningOnline Network



Writes module on energy conservation



Includes the two into her unit on conservation laws



Writes module on momentum conservation



Uses that unit in his course

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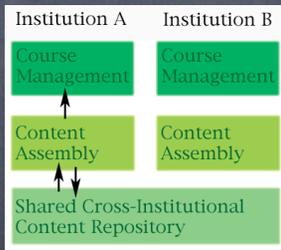


LearningOnline Network



- Currently used at 3 middle schools, 18 high schools, 4 community colleges, and 24 universities





Top: Complete Course Management System

- Course Navigation Tools
- Communication features (discussion, thread)
- Announcements
- Portfolio space
- Homework, Exams (online/offline)

edu tools SM Providing decision-making tools for the **E-D-U** community

Edutools Home **Course Management Systems** Student Services e-Learning Policies Future Development About Edutools

◆ Product Information ◆ Compare Products ◆ Make a Decision Help News Links Search

[Home](#) > [Course Management Systems](#)

Course Management Systems

This site was built to assist higher education in using a more rational decision making process to review the many options for a course management system.

This site reviews each product by researching and describing more than 40 product features.

Most Recent Product Reviews

- ▶ [LON-CAPA 1.1](#)
- ▶ [ANGEL 6.0](#)
- ▶ [ILIAS](#)
- ▶ [Manhattan Virtual Classroom 2.1](#)
- ▶ [ATutor 1.3](#)

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LON-CA

SF

Interface internationalized, multilingual content enabled

Change Your Language Preferences

The screenshot displays the LON-CAPA user interface in a multilingual state. The browser's address bar shows "LON-CAPA" and "Welcome Set-Up Page". The main content area is divided into two columns: "Importieren eines veröffentlichten Dokumentes" (Importing a published document) and "Spezielle Dokumente" (Special documents). The "Importieren" section includes buttons for "Suchen" (Search), "Importieren" (Import), "Wähle Seite/Sequenz" (Select page/sequence), and "Lade Seite/Sequenz" (Load page/sequence). The "Spezielle Dokumente" section lists various document types with help icons: "Neuer Ordner" (New folder), "External Resource", "Kursüberblick" (Course overview), "Inhaltsverzeichnis" (Table of contents), "Einfache Seite" (Simple page), "Einfache Aufgabe" (Simple task), "Formular zum Hochladen von Noten" (Form for uploading grades), "Schwarzes Brett" (Blackboard), and "Meine persönliche Information" (My personal information). On the left, a "メインメニュー" (Main menu) is visible, listing various roles and functions such as "ROLES", "DOCS", "NAV", "SPRS", "CHRT", "STAT", "ENRL", "CUSR", "PARM", and "RES". The interface also shows a "Обнови" (Refresh) button at the bottom left.

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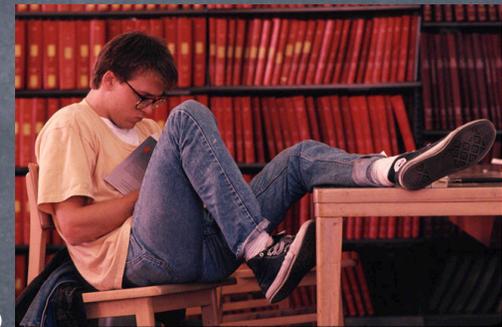
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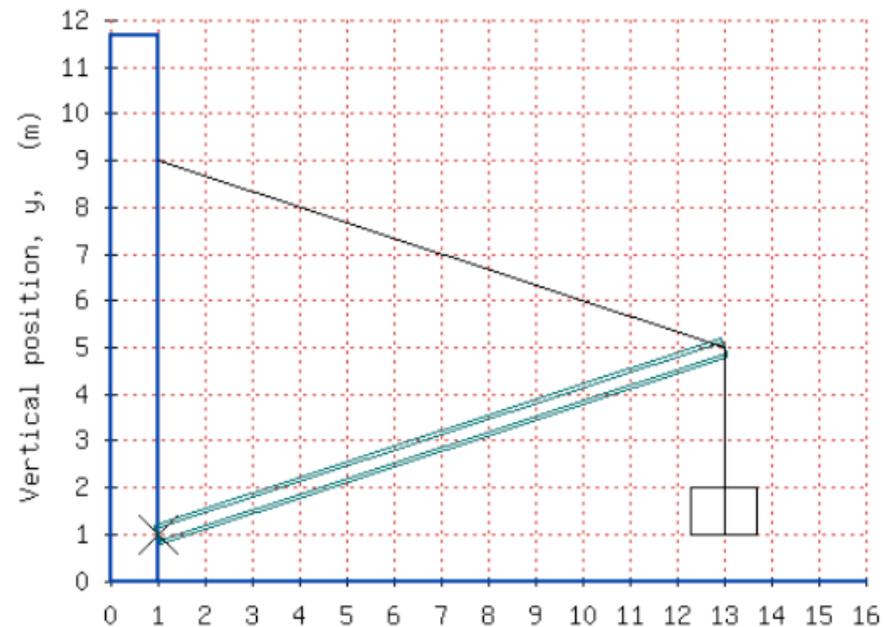
LON-CAPA's Approach

- Online assessment with immediate adaptive feedback and multiple tries
- Different students get different versions of the same problem
 - different options
 - different graphs or images
 - different numbers or formulas



Same
problem,
two
students

A crate with a mass of 155.5 kg is suspended from the end of a uniform boom with mass of 89.5 kg. The upper end of the boom is supported by a cable attached to the wall and the lower end by a pivot (marked X) on the same wall. Calculate the tension in the cable.



Formative Assessment

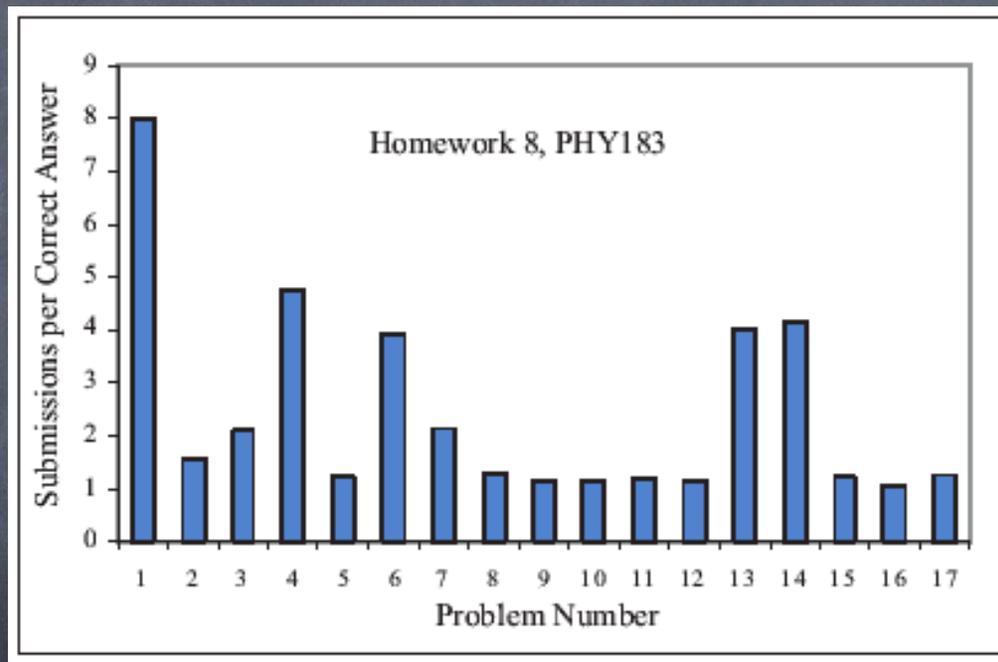
- Feedback to the student
 - “how am I doing?”
 - “what is expected?”
- Feedback to the instructor
 - “how is my class doing?”
 - “what do I need to deal with, and what not?”
 - Just-In-Time Teaching
(reading and problems due before class)



Feedback to Instructor

One Homework Set

Average Number of Tries as a Measure of Difficulty



Feedback to Instructor

Resource: Two Charges

View of the problem - [View](#) [View](#) [View](#)

Two opposite charges are placed some distance apart in a vacuum.

What will happen if ...?

- One forth the force: The distance between the charges is doubled.
- Double the force: The magnitude of one of the two charges is doubled.
- Four times the force: The magnitude of both charges is doubled.
- Four times the force: The distance between the two charges is cut in half.
- Half the force: The charges are placed in a medium with a factor two higher permittivity.

You are correct.
Your receipt is 498-1666 ?

Correct answer:

Answer for Part:0 One forth the force Double the force Four times the force Four times the force Half the force

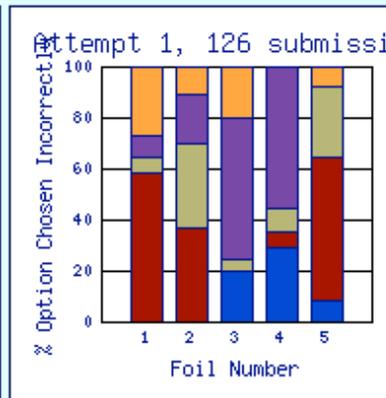
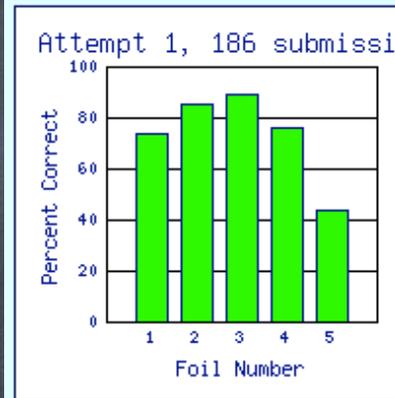
Fullname: [View](#) [View](#) [View](#)

Date/Time	Submission	Status												
Mon Jan 19 20:15:19 2004	Part 0 (ID 11) Trial 1 <table border="1"> <tr> <td>Answer</td> <td>One forth the force</td> <td>Double the force</td> <td>Four times the force</td> <td>Four times the force</td> <td><i>Double the force</i></td> </tr> <tr> <td>Option ID</td> <td>1_6_1_4_2</td> <td>1_6_1_3_2</td> <td>1_6_1_2_2</td> <td>1_6_1_1_2</td> <td>1_6_1_5_2</td> </tr> </table>	Answer	One forth the force	Double the force	Four times the force	Four times the force	<i>Double the force</i>	Option ID	1_6_1_4_2	1_6_1_3_2	1_6_1_2_2	1_6_1_1_2	1_6_1_5_2	Part 0 incor
Answer	One forth the force	Double the force	Four times the force	Four times the force	<i>Double the force</i>									
Option ID	1_6_1_4_2	1_6_1_3_2	1_6_1_2_2	1_6_1_1_2	1_6_1_5_2									
Mon Jan 19 20:15:29 2004	Part 0 (ID 11) Trial 2 <table border="1"> <tr> <td>Answer</td> <td>One forth the force</td> <td>Double the force</td> <td>Four times the force</td> <td>Four times the force</td> <td><i>Four times the force</i></td> </tr> </table>	Answer	One forth the force	Double the force	Four times the force	Four times the force	<i>Four times the force</i>	Part 0 incor						
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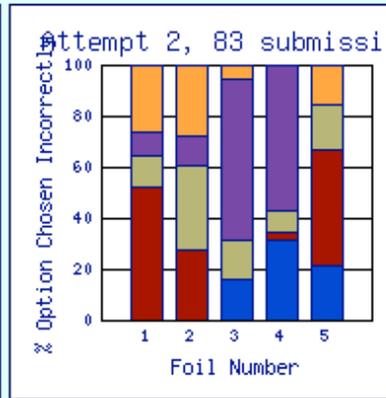
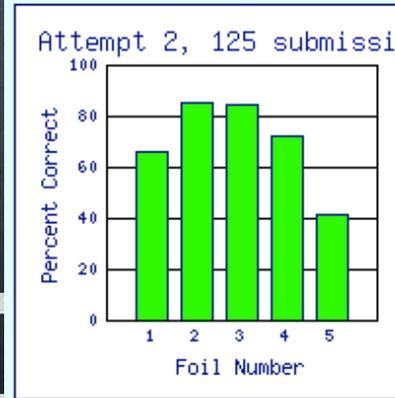


Problem Analysis

Foil Number	Foil Name	Foil Text	Correct Value
1	1_6_1_1_2	The distance between the two charges is cut in half.	Four times the force
2	1_6_1_2_2	The magnitude of both charges is doubled.	Four times the force
3	1_6_1_3_2	The magnitude of one of the two charges is doubled.	Double the force
4	1_6_1_4_2	The distance between the charges is doubled.	One forth the force
5	1_6_1_5_2	The charges are placed in a medium with a factor two higher permittivity.	Half the force



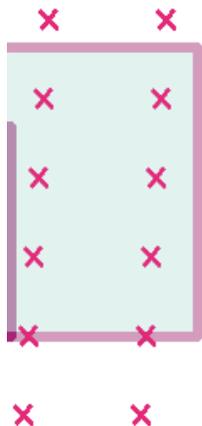
- One forth the force
- Half the force
- Same force
- Double the force
- Four times the force



- One forth the force
- Half the force
- Same force
- Double the force
- Four times the force



Formative Assessment: Peer-Teaching



You are looking down on a single coil in a constant magnetic field $B = 0.8 \text{ T}$ which points directly into of the screen. The dimensions the coil go from $a = 13 \text{ cm}$ and $b = 15 \text{ cm}$, to $a^* = 23 \text{ cm}$ and $b^* = 22 \text{ cm}$ in $t = 0.038 \text{ seconds}$. If the coil has resistance that remains constant at 1.7 ohms . What would be the magnitude of the induced current in amperes?

$$I = 0.39 \text{ Amperes}$$

Computer's answer now shown above. Tries 0/12

[Threaded View](#) [Chronological View](#) [Sorting/Filtering options](#) [Export?](#)

[redacted] [anonymous] [Hide](#) [Delete](#) [Submissions](#) (Sat Feb 19 16:21:53 2005)

I tried using Faraday's Law for a changing area and then using Ohm's Law to find the current, but without success. Does anyone know how to do this one?

Re: [redacted] [anonymous] [Hide](#) [Delete](#) [Submissions](#) (Sun Feb 20 17:15:48 2005)

for your first equation use:

$$V = NB \cos(\theta) \frac{dA}{dt}$$

dA/dt is just your change in area (make sure that you convert to meters correctly) over the time that is given to you.

Solve for V and then plug V into the equation for Ohm's law:

$$I = V/R$$

Re: Re: [redacted] [anonymous] [Hide](#) [Delete](#) [Submissions](#) (Sun Feb 20 19:25:04 2005)

what is N ?

Quick question [redacted] [Hide](#) [Delete](#) [Submissions](#) (Sun Feb 20 20:46:39 2005)

Summative Assessment

Directions for Marking

1. Make dark marks in the circles for each answer.
2. Make dark marks in the circles for each answer.
3. Make dark marks in the circles for each answer.
4. Make dark marks in the circles for each answer.

Example: A B C D

PLEASE WRITE YOUR RESPONSES WITHIN THIS BOX

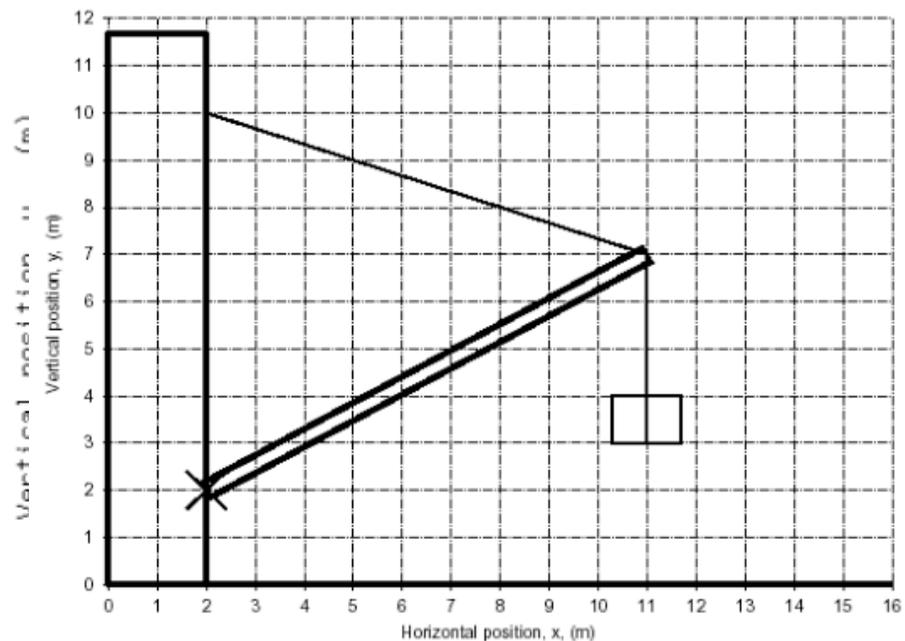
YOUR LAST NAME: _____ PTID: _____

SECTION: _____ CODE: _____

021611

A crate with a mass of 177.5 kg is suspended from the end of a uniform boom with mass of 88.5 kg. The

1 pt A crate with a mass of 177.5 kg is suspended from the end of a uniform boom with mass of 88.5 kg. The upper end of the boom is supported by a cable attached to the wall and the lower end by a pivot (marked X) on the same wall. Calculate the tension in the cable.



(in N)

22. A 2.58×10^3 B 2.92×10^3 C 3.29×10^3
 D 3.72×10^3 E 4.21×10^3 F 4.75×10^3
 G 5.37×10^3 H 6.07×10^3



Summative Assessment

A capacitor is completely charged with 650 nC by a voltage source that had 350 V.

1 pt What is its capacitance? (in F)

- 7.A 1.49×10^{-9} B 1.86×10^{-9} C 2.32×10^{-9}
D 2.90×10^{-9} E 3.63×10^{-9} F 4.53×10^{-9}
G 5.67×10^{-9} H 7.08×10^{-9}

1 pt Now the plates of the charged capacitor are pushed together with the voltage source already disconnected.

8. A The charge on the plates increases.
B The energy stored in the capacitor remains the same.
C The capacitance increases.
D The voltage drop between the plates increases.
E The energy stored in the capacitor increases.

1 pt The initial air gap was 8 mm. What is the stored energy if the air gap is now 6 mm? (in J)

- 9.A 0.00 B 8.53×10^{-5} C 1.14×10^{-4}
D 1.30×10^{-4} E 1.52×10^{-4} F 3.41×10^{-4}
G 3.44×10^{-4} H 4.87×10^{-4}

A capacitor is completely charged with 670 nC by a voltage source that had 350 V.

1 pt What is its capacitance? (in F)

- 7.A 1.91×10^{-9} B 2.39×10^{-9} C 2.99×10^{-9}
D 3.74×10^{-9} E 4.67×10^{-9} F 5.84×10^{-9}
G 7.30×10^{-9} H 9.13×10^{-9}

1 pt Now the plates of the charged capacitor are pulled apart with the voltage source already disconnected.

8. A The voltage drop between the plates increases.
B The energy stored in the capacitor remains the same.
C The charge on the plates increases.
D The capacitance increases.
E None of the above.

1 pt The initial air gap was 6 mm. What is the stored energy if the air gap is now 11 mm? (in J)

- 9.A 0.00 B 6.40×10^{-5} C 1.17×10^{-4}
D 2.15×10^{-4} E 2.91×10^{-4} F 3.63×10^{-4}
G 4.39×10^{-4} H 5.42×10^{-4}



Turning Summative into Formative

A capacitor is completely charged with 650 nC by a voltage source that had 350 V.

1 pt What is its capacitance? (in F)

7. A 1.49×10^{-9} B 1.86×10^{-9} C 2.32
 D 2.90×10^{-9} E 3.63×10^{-9} F 4.53
 G 5.67×10^{-9} H 7.08×10^{-9}

1 pt Now the plates of the charged capacitor are together with the voltage source already disconnected.

8. A The charge on the plates increases.
 B The energy stored in the capacitor remains the same.
 C The capacitance increases.
 D The voltage drop between the plates increases.
 E The energy stored in the capacitor increases.

1 pt The initial air gap was 8 mm. What is the stored energy if the air gap is now 6 mm? (in J)

9. A 0.00 B 8.53×10^{-5} C 1.14×10^{-4}
 D 1.30×10^{-4} E 1.52×10^{-4} F 3.41×10^{-4}
 G 3.44×10^{-4} H 4.87×10^{-4}

A capacitor is completely charged with 670 nC by a voltage source that had 350 V.

Problem 6

Due on Tuesday, Feb 22 at 10:00 am

A capacitor is completely charged with 640 nC by a voltage source that has 375 V.

What is its capacitance?

Tries 0/3

Now the plates of the charged capacitor are pulled apart with the voltage source still connected.

- The capacitance increases.
 The voltage drop between the plates increases.
 The energy stored in the capacitor increases.
 The energy stored in the capacitor remains the same.
 None of the above.

Tries 0/2

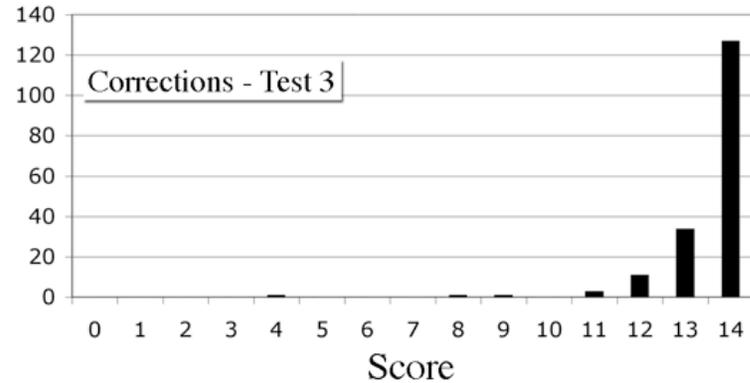
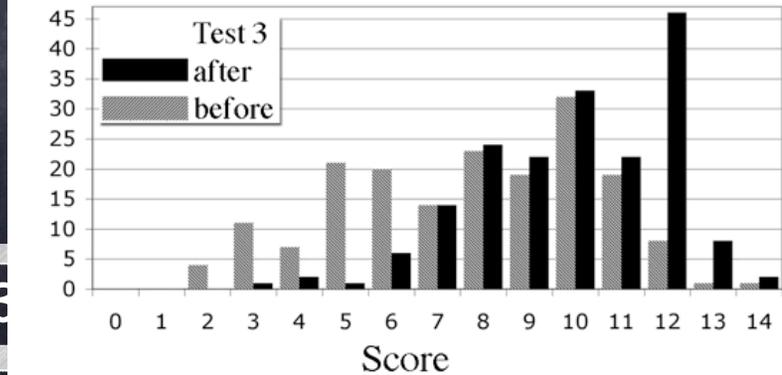
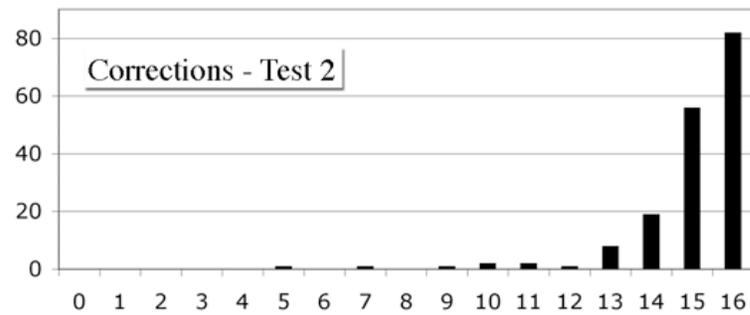
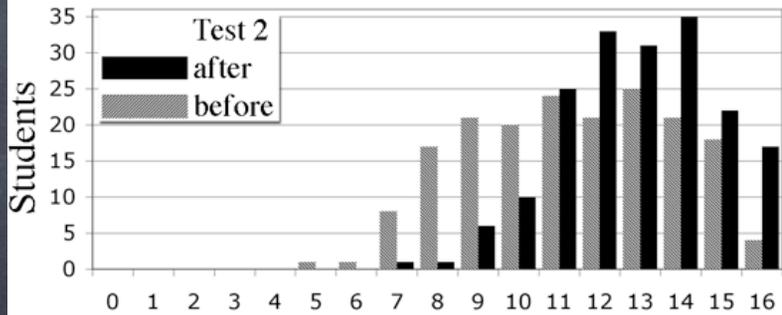
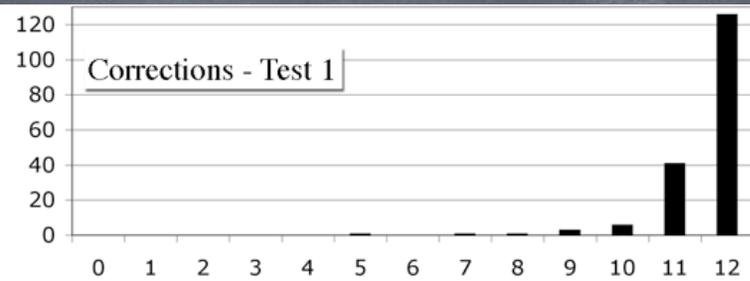
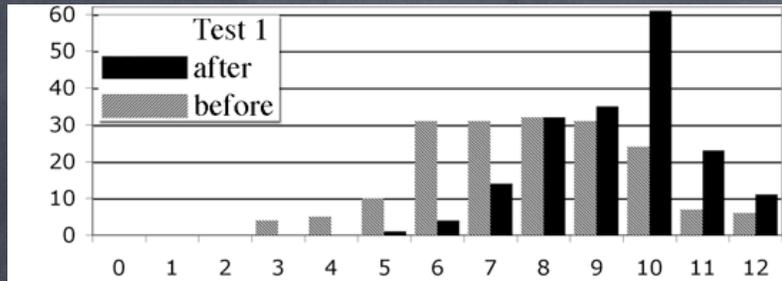
The initial air gap was 5 mm. What is the stored energy if the air gap is now 10 mm?

Tries 0/3

9. A 0.00 B 6.40×10^{-4} C 1.17×10^{-4}
 D 2.15×10^{-4} E 2.91×10^{-4} F 3.63×10^{-4}
 G 4.39×10^{-4} H 5.42×10^{-4}



Turning Summative into Formative



LON-CAPA

- Learning Content Management System
- Assessment System
- Open-Source and Free



LON-CAPA

- Open-source free software
- GNU General Public License
- No license fees
- Can be modified, extended, improved, adapted ...
- Developed by educators for educators



Open Source

- Code contributions by
 - Florida State University
 - Ohio University
 - Simon Fraser University Vancouver
 - Hebrew University Jerusalem
 - UNICAMP São Paulo
 - Nagoya University



Runs on what?

- Runs on Intel or AMD hardware
- Approx. 200 concurrent sessions per server
- Linux operating system
 - Standard free distributions: Fedora, SUSE
 - Enterprise versions: Redhat Enterprise Server
- No additional database, etc, needed



LON-CAPA

Does it work?



Effectiveness

LON-CAPA is a tool, not a curriculum.
Effectiveness depends on how it is used.

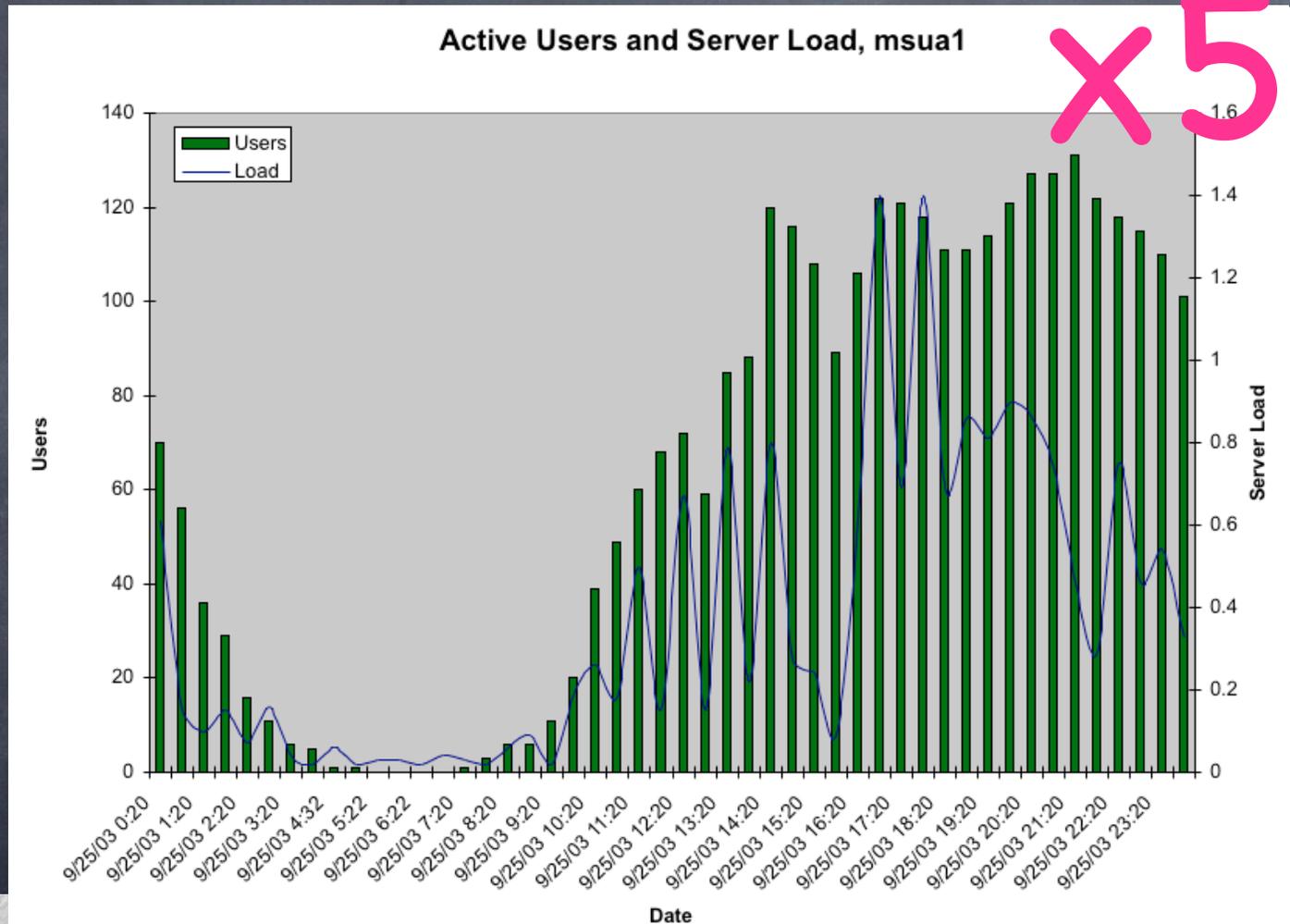
39

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Time on Task: 10,000 students

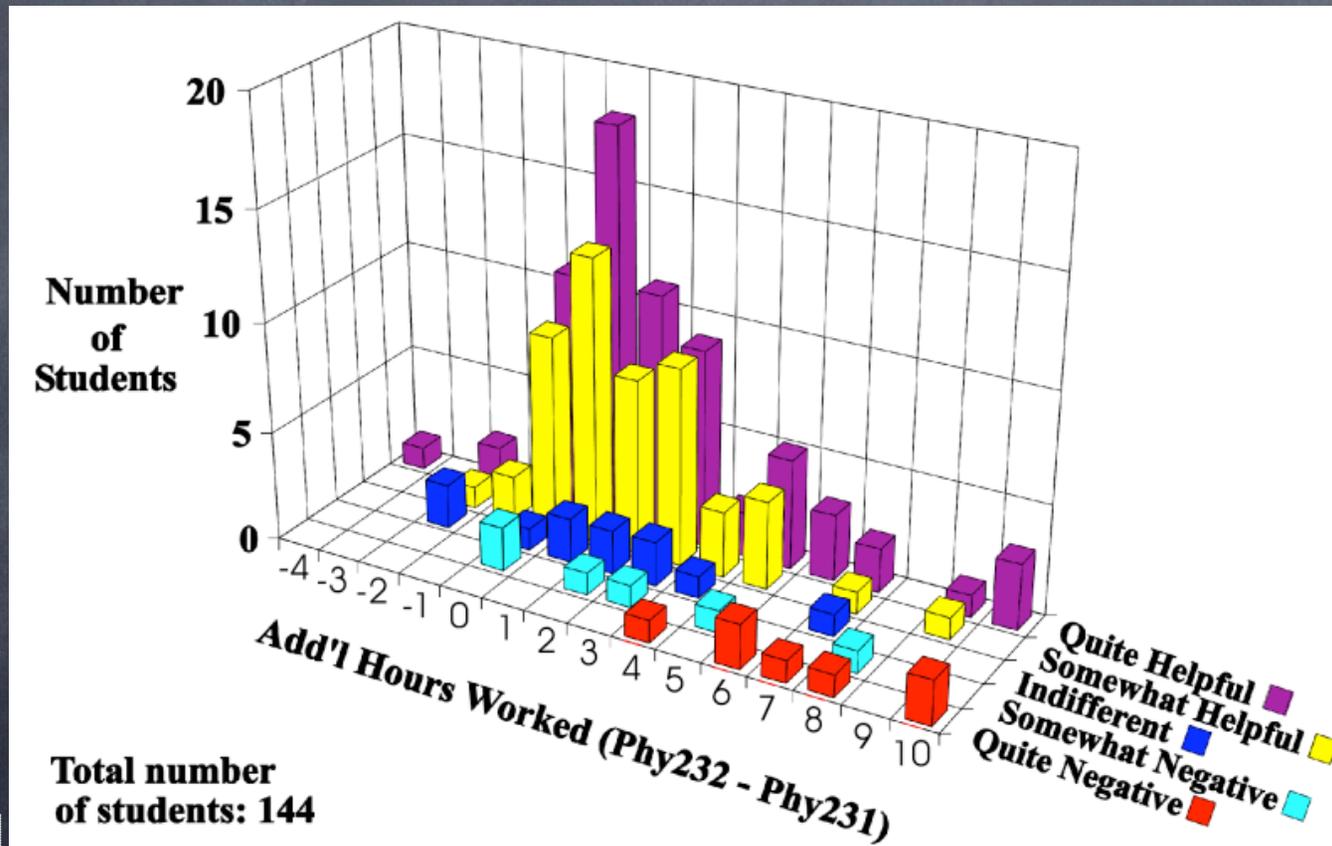


Time-On-Task

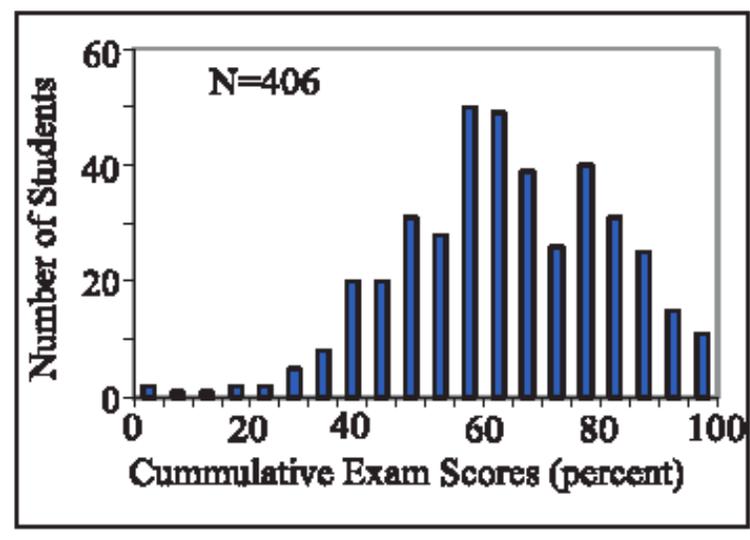
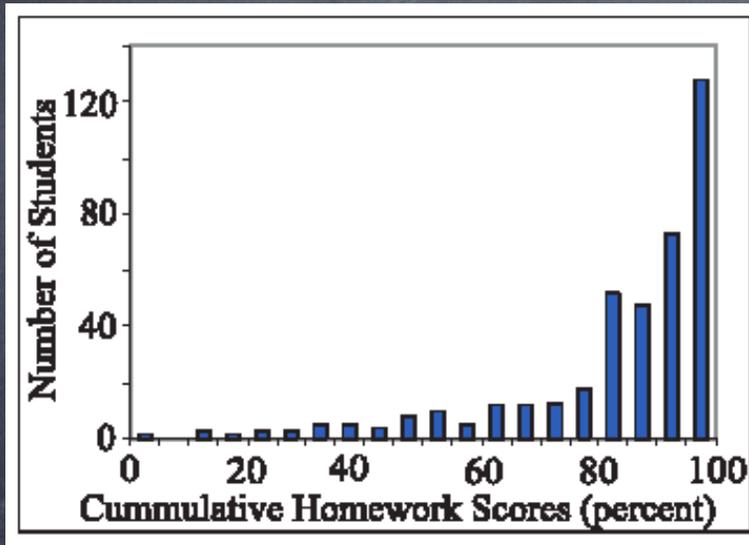
- Academic year 2004/2005
- Approx 12,600 (fall) and 10,800 (spring) MSU students
- 100,000 logins 16 days into the year
- 1,000,000 logins by March, seven months into the year
- Approx 30,000 students systemwide



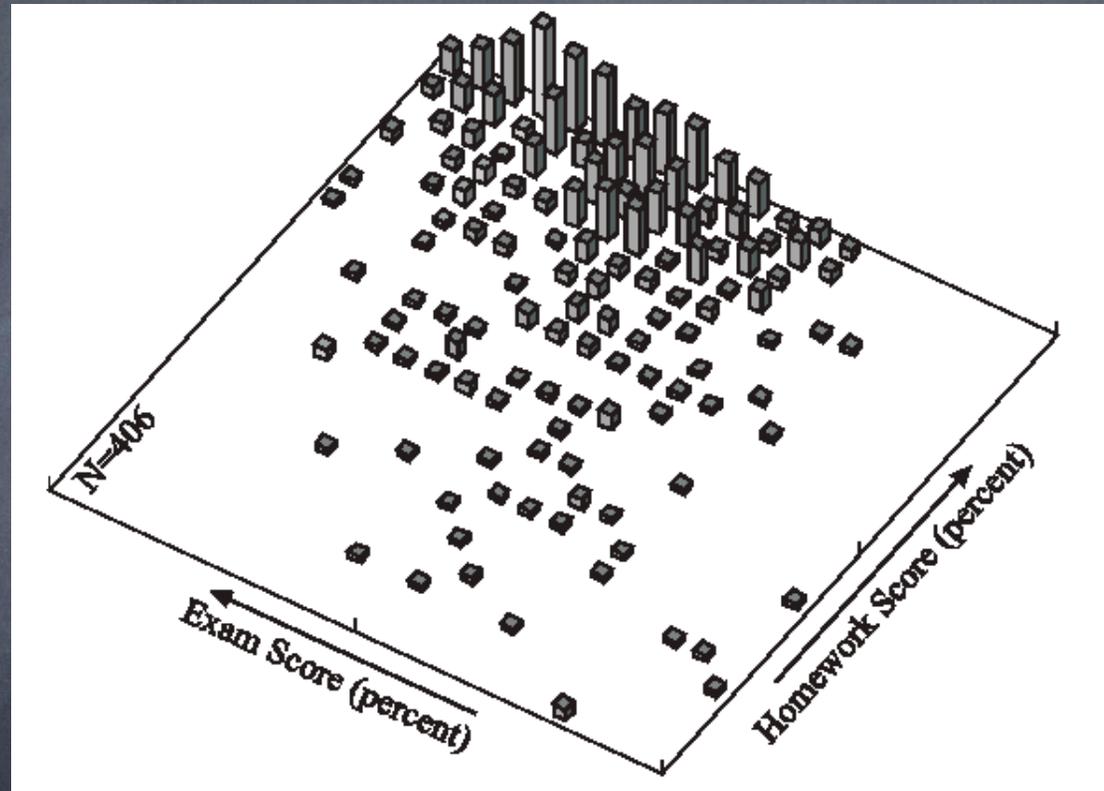
Before/After Time-On-Task vs. Perceived Helpfulness



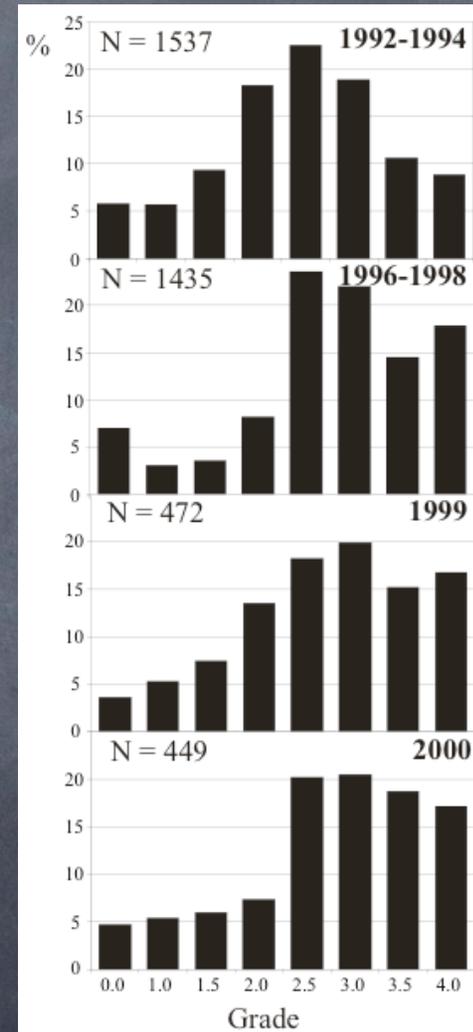
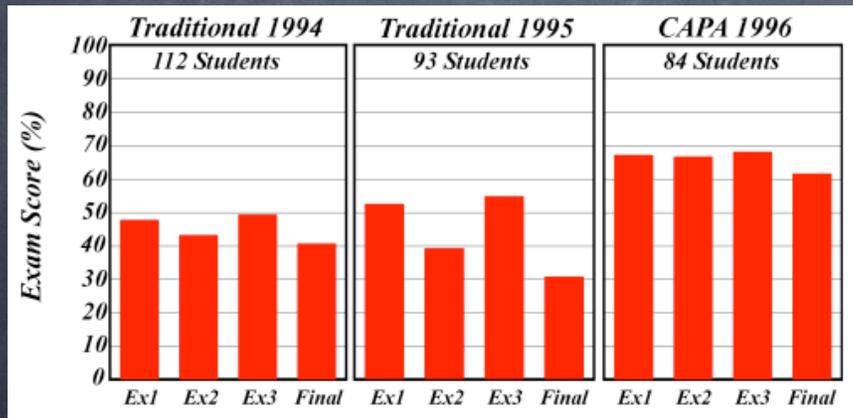
Formative vs. Summative



Formative vs. Summative



Exam and Course Grades



45

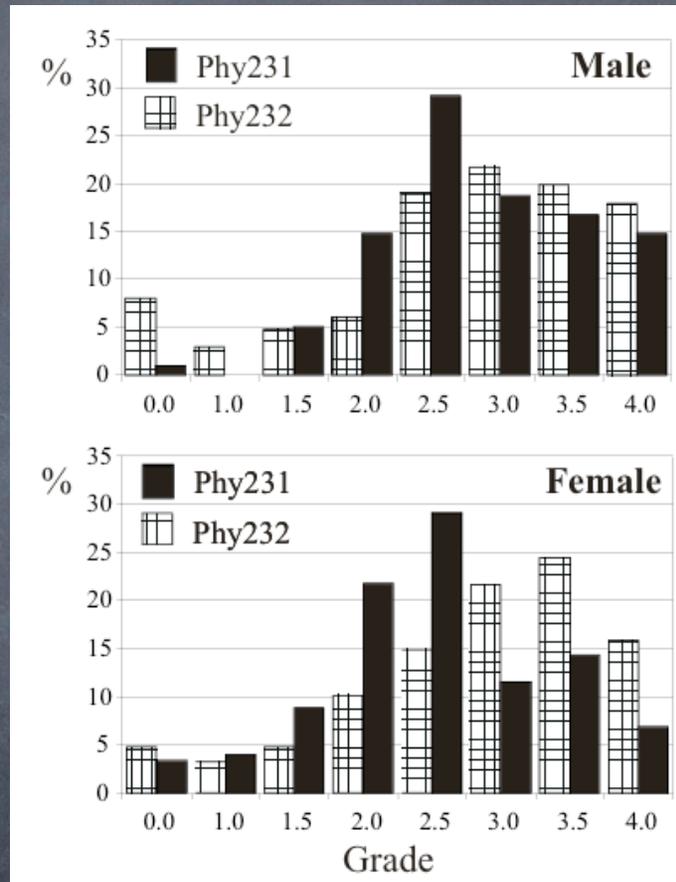
LON-CAPA



UNIVERSITY

Gender Differential

- phy231: traditional
- phy232: CAPA



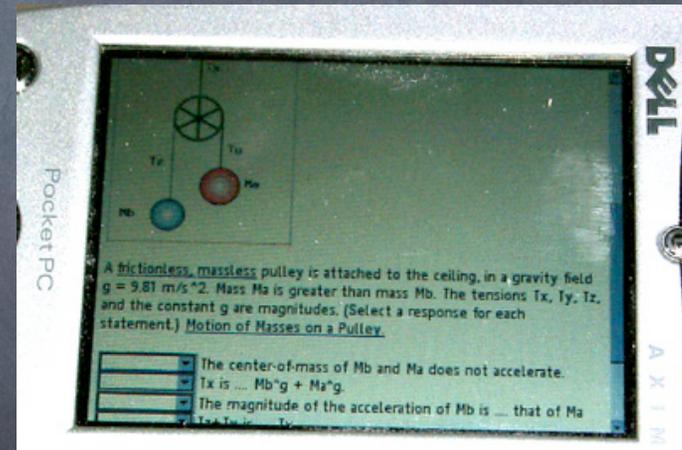
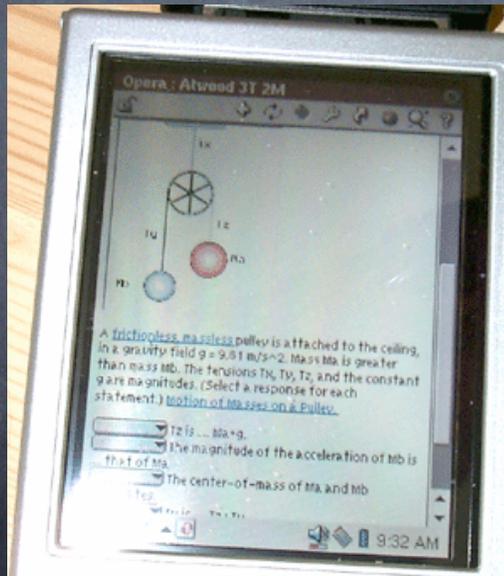
LON-CAPA

What's
Next?

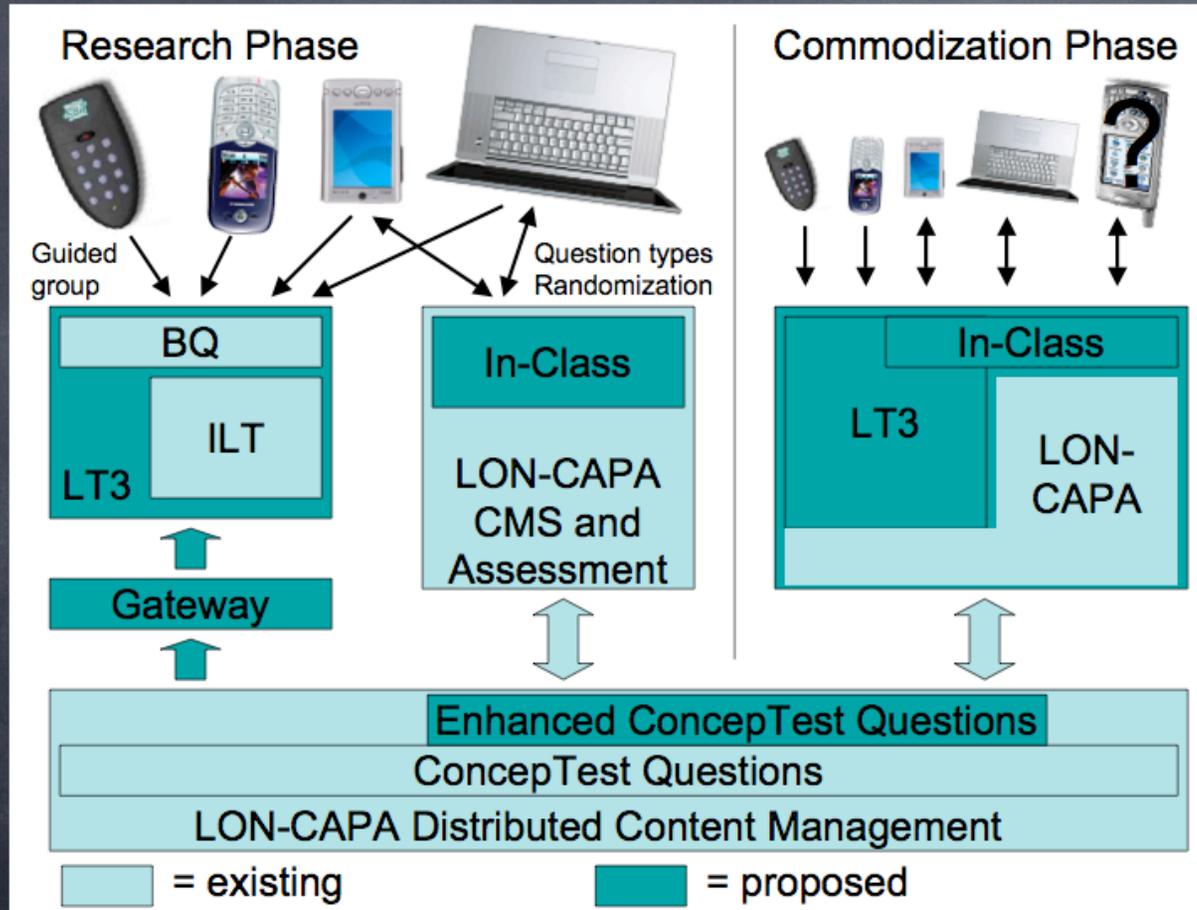


Formative Assessment in Class

- In-Class Use of LON-CAPA
- Partnering with Harvard (Mazur group) and Eckerd (Junkin) on next generation "clickers"



Formative Assessment in Class



Funding

- Initially developed at Michigan State University
- Additional funding of CAPA by Sloan and Mellon Foundations
- Today funded by Michigan State University, publisher and service contracts, and the National Science Foundation within the ITR and CCLI-ASA programs



Your task right now

- Write down:
 - What you would like to hear more about regarding LON-CAPA
 - Your tool needs in e-learning
- Hand in the sheet to me, so I can adjust talks and topics



Project Website:
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