The End of the University as We Know It?

Wolfgang Bauer

Michigan State University

Learning to Cook

- Method 1: buy a cookbook and follow instructions

Learning to Cook

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- Method 1(a): (really still method 1, but with more modern delivery technology)

Learning to Cook

- Method 2: take an internship with a famous cook
  - Immersive
  - One-on-one attention
  - Immediate feedback
  - Rigorous quality control

BUT:

  - Very expensive
  - Can only be done for a few

Learning to Cook

- Method 3:
  - Select presentations from best chefs in the world
  - Detailed instructions from many sources
  - Send in your finished dishes for taste-tests
  - Receive feedback (email, text, … from assistants of chefs)
  - Repeat
  - Final exam (for credit): perform in front of judges



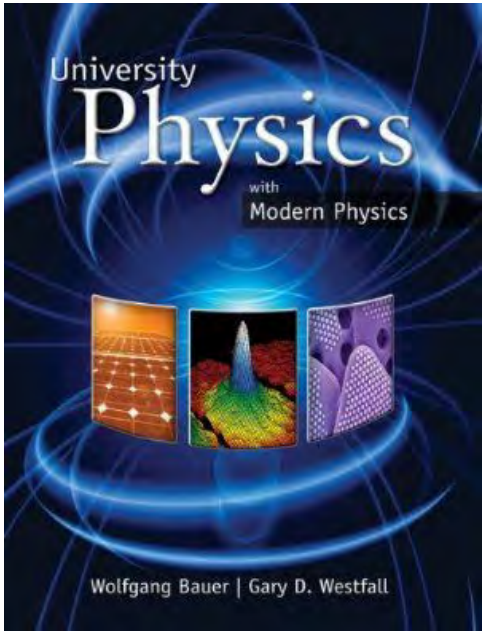


Learning to Cook

- Method 3 (cont.): provide a learning community
  - Exchange of ideas between learners
  - Create more than what teachers designed initially

Learning to Do Physics

- Method 1: Buy a book *and read it*
  - Still **highly** recommended!
- Method 2: Enroll in a university
  - Attend physics lectures
  - In addition to method 1(!)
- Method 3: Take an online class
  - Digest materials at your own pace and on your own schedule
  - Select from different explanations by different experts and via different learning styles
  - Use a variety to formative and summative evaluation tools



Virtual University Physics @MSU

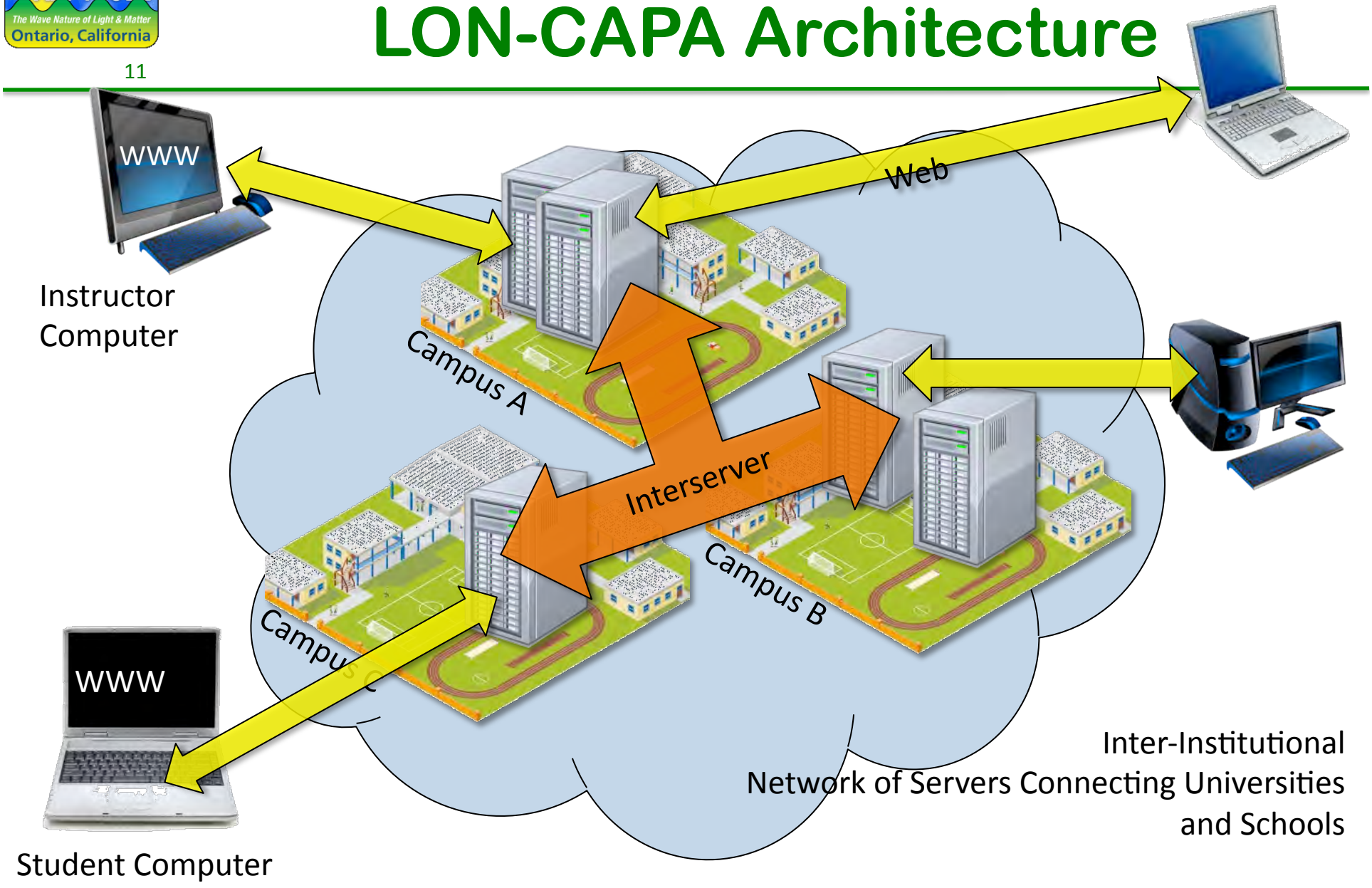
- 1992: Presidential Faculty Fellow Award (k$500)
- 1993: NSF-ILI grant (k$45+45) to improve lab/lecture sequence in LBS (Bauer, Benenson, Westfall)
- 1995: MultiMedia Physics CD
- 1997: *lecture*Online (Kortemeyer)
- 1997: Virtual University courses PHY231c, PHY232c
- 1998: cliXX Physik CD (Germany)
- 1998: HHMI grant (M$1.8, McGroarty)
- 1999: Advanced Placement Physics
- 2000: MSU-deal with Apex Learning
- 2000: NSF-ITR grant (M$2.1) for LON-CAPA (Kortemeyer, Bauer, Kashy[2], Speier)
- 2008: Complete redo of all VU course offerings with Camtasia
- 2012: Current annual enrollment ~1,200/year
- 2013: Start Astronomy VU

Delivery Vehicle

LON-CAPA

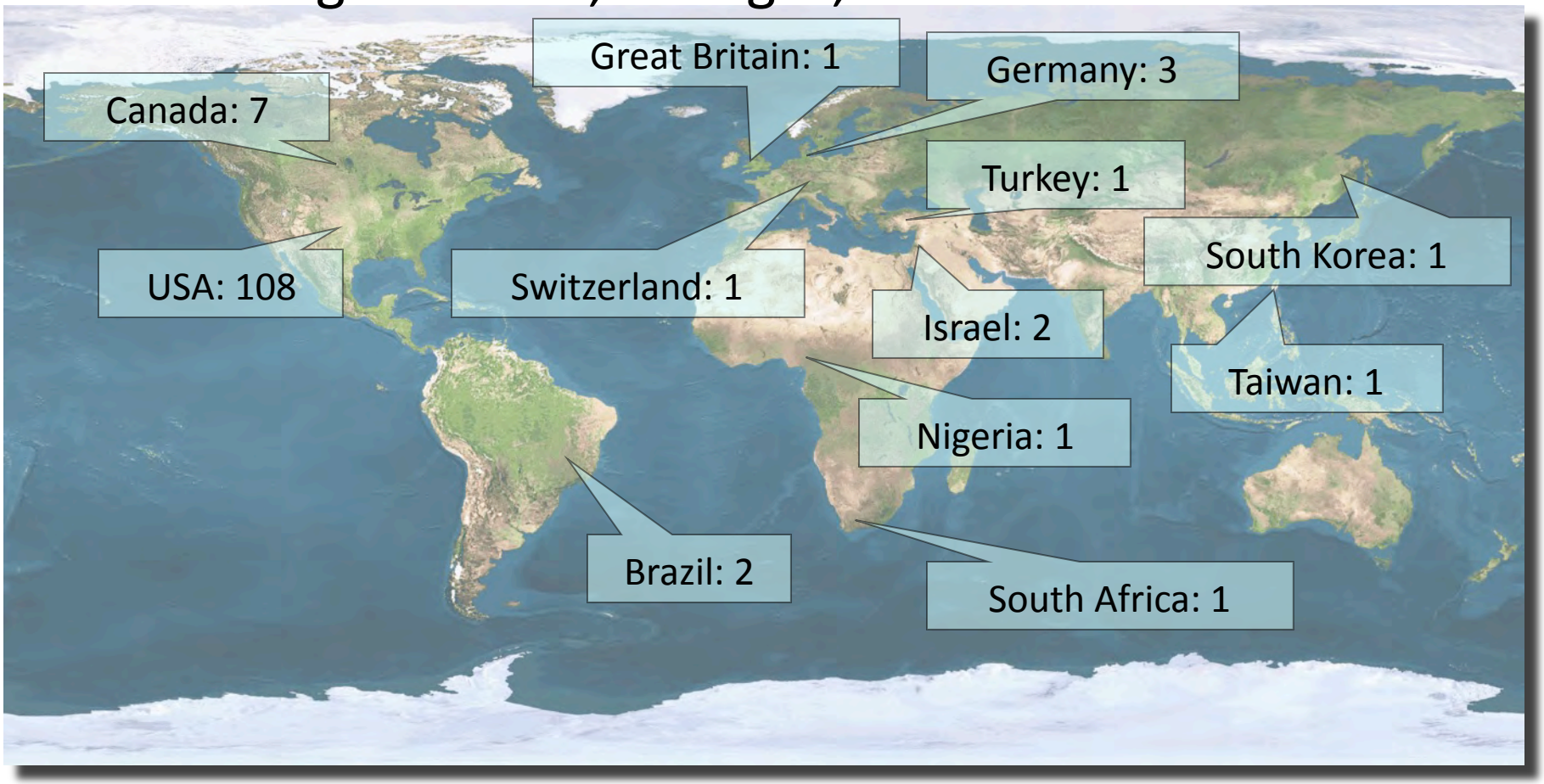
- Learning Online Network
- Computer-Assisted Personalized Approach
- Course management system
- Homework engine
  - Individualized
    - Every student sees the same basic problem
    - Every student has different numbers
    - Allows groups of students to work together without the ability to just copy solutions
  - Reusable shared resources
    - Much more efficient use of instructor's time

LON-CAPA Architecture



The LON-CAPA Community

High Schools, Colleges, and Universities

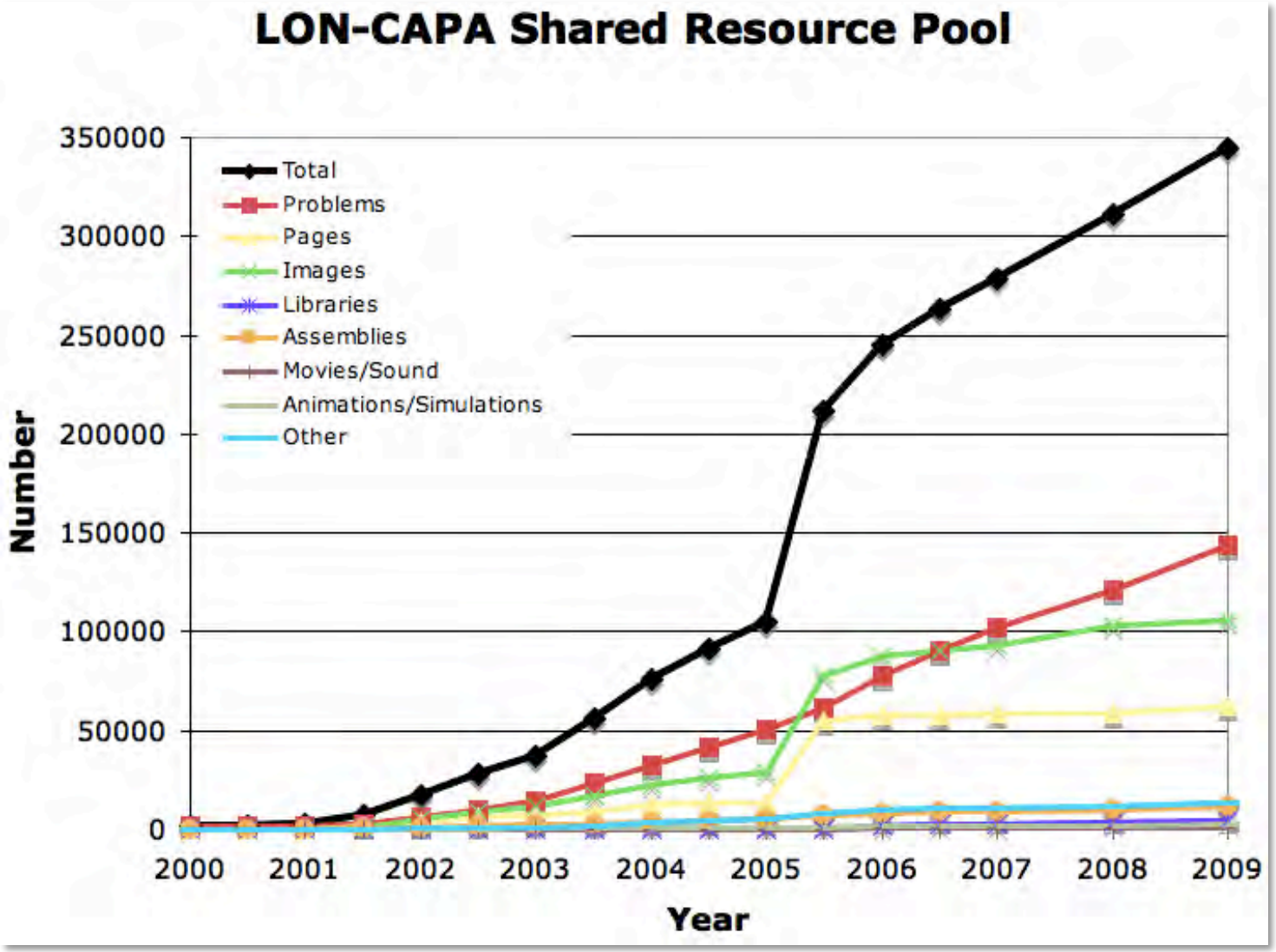


… plus grant projects and publishing companies.

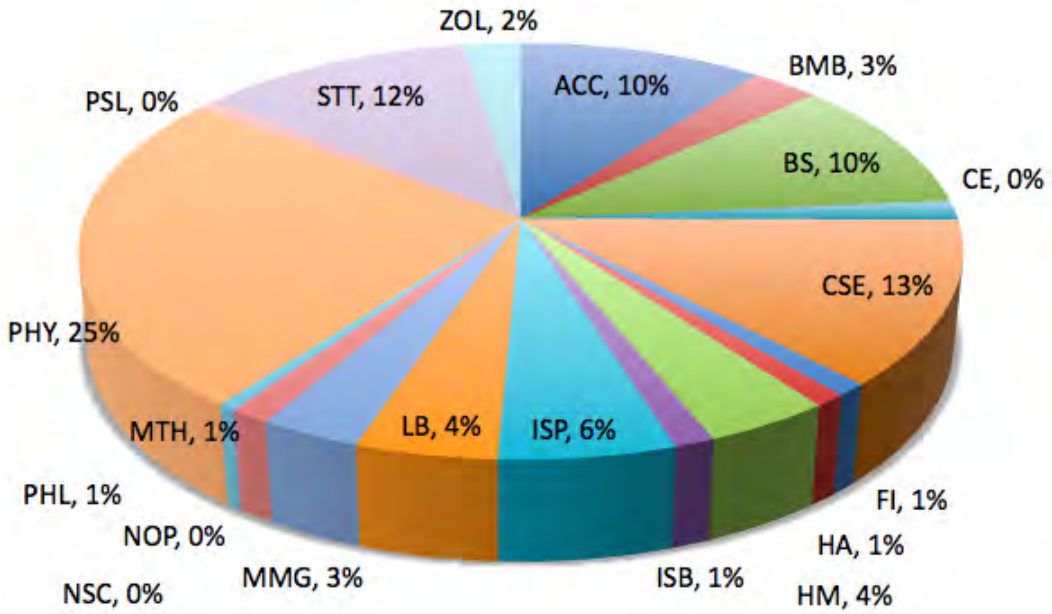
Sharing of Resources!

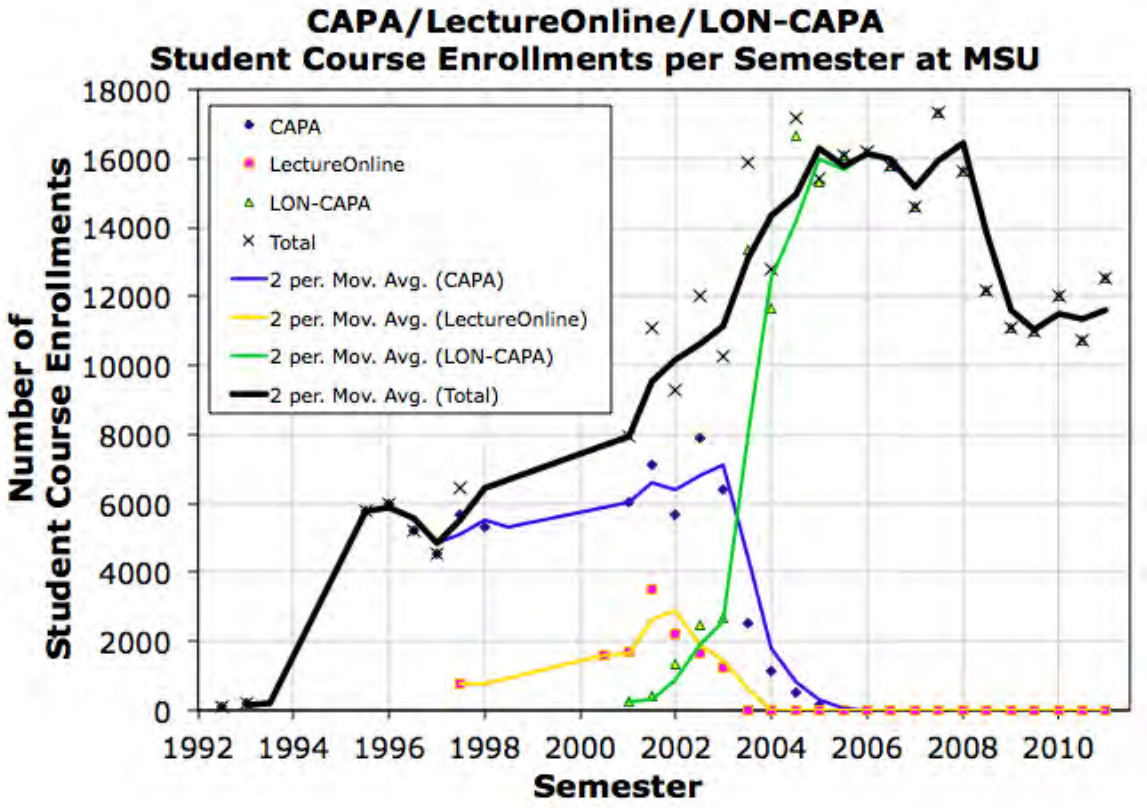
- Creating online resources is a lot of work
- Doing so for use in just one course is a waste of time and effort
- Many resources can be used among a number of courses and across institutions

LON-CAPA Community



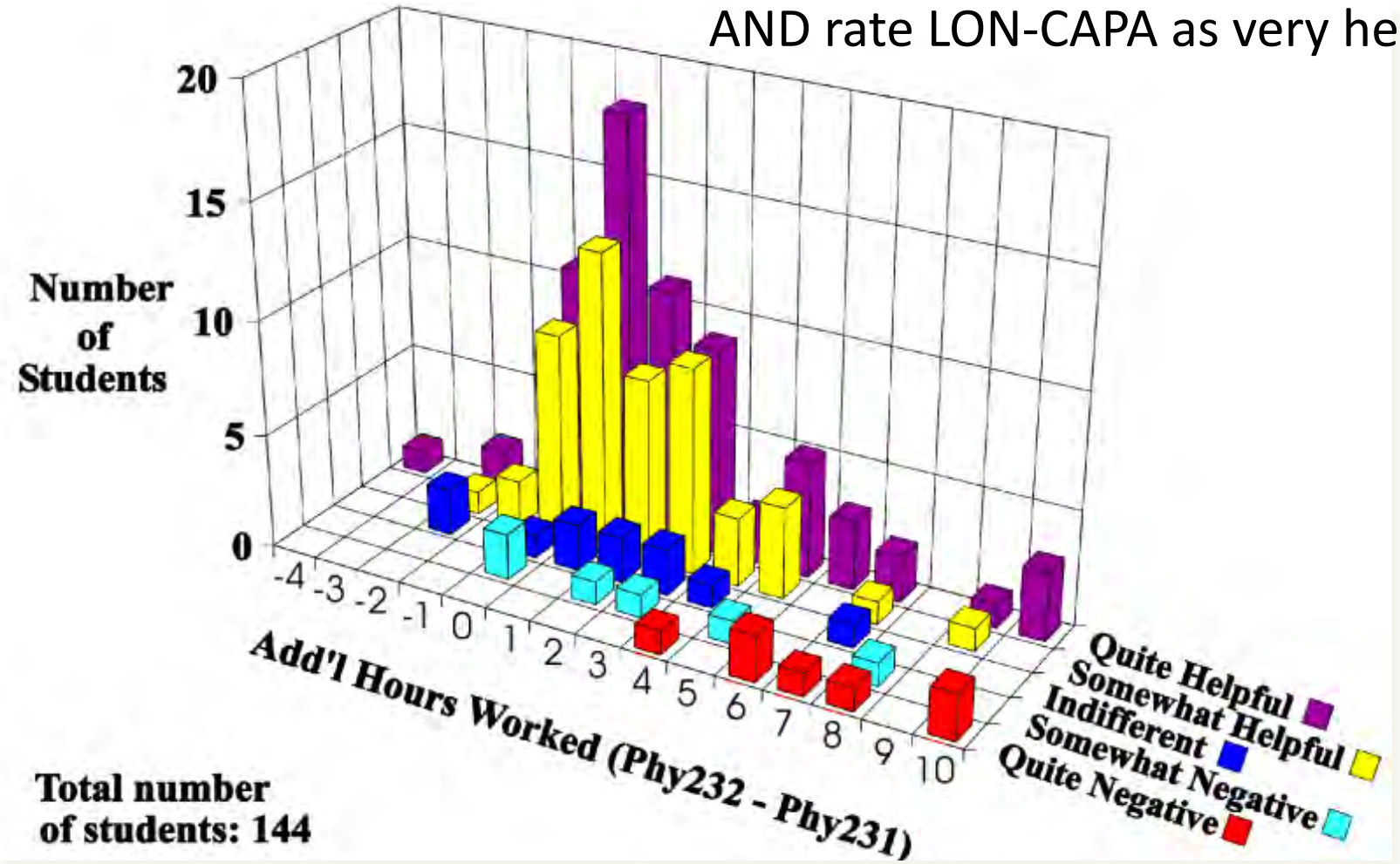
Use @ MSU


ZOL, 2%
ACC, 10%
BMB, 3%
BS, 10%
CE, 0%
CSE, 13%
FI, 1%
HA, 1%
HM, 4%
ISB, 1%
ISP, 6%
LB, 4%
MMG, 3%
NOP, 0%
NSC, 0%
PHL, 1%
PHY, 25%
MTH, 1%
PSL, 0%
STT, 12%


CAPA/LectureOnline/LON-CAPA
Student Course Enrollments per Semester at MSU
Number of Student Course Enrollments
Semester
CAPA
LectureOnline
LON-CAPA
Total
2 per. Mov. Avg. (CAPA)
2 per. Mov. Avg. (LectureOnline)
2 per. Mov. Avg. (LON-CAPA)
2 per. Mov. Avg. (Total)
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

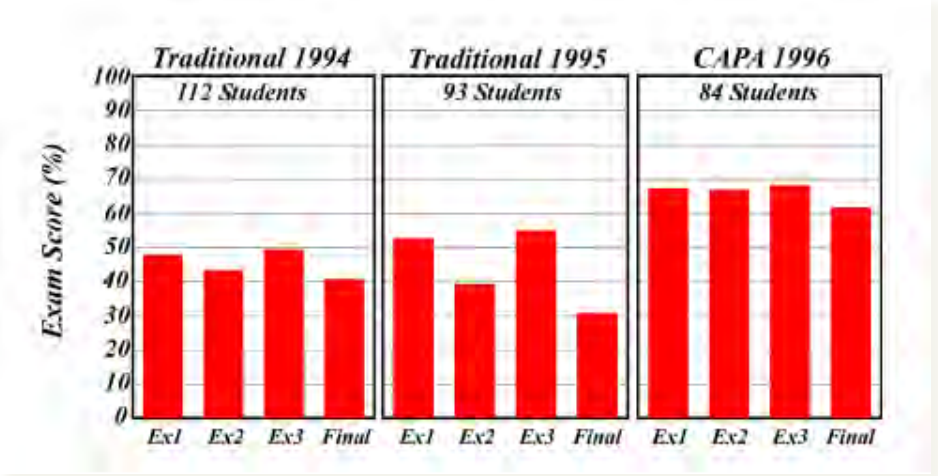
Selected Results: PER on LON-CAPA

Students spend more time on task AND rate LON-CAPA as very helpful!



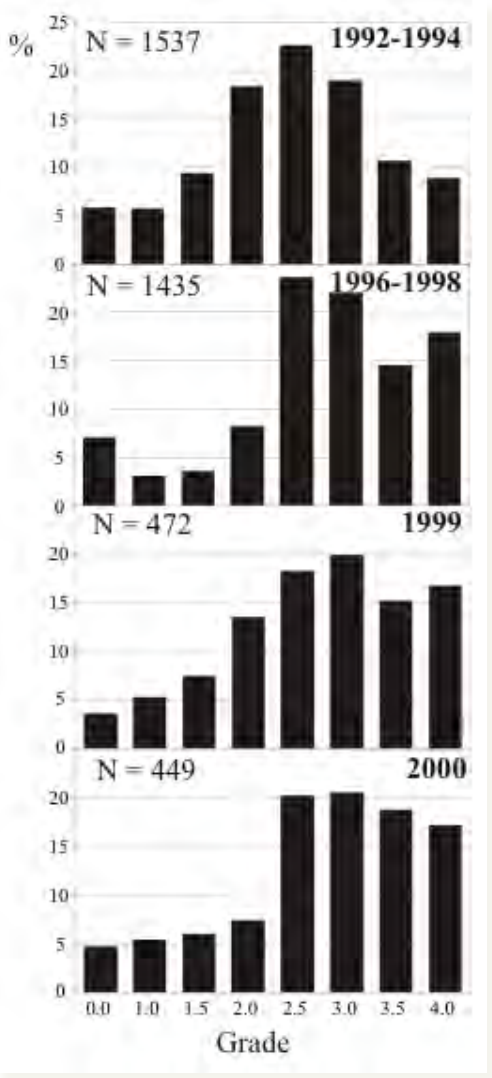
Selected Results: PER on LON-CAPA

- Improved Exam Performance



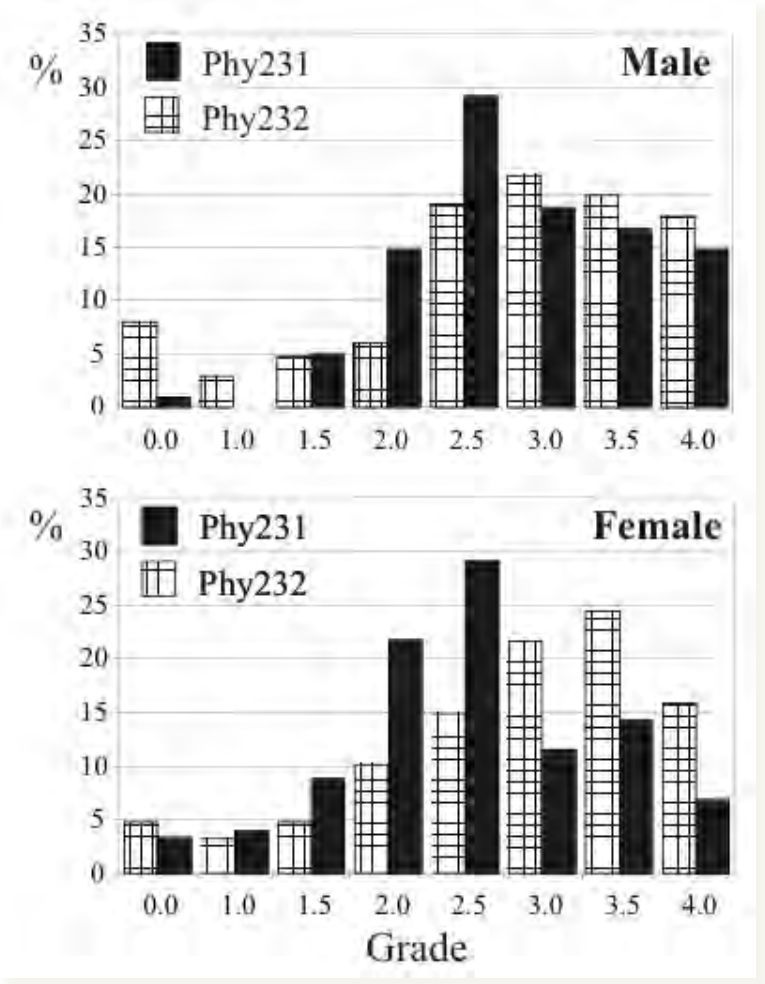
Selected Results: PER on LON-CAPA

- Improved Course Performance

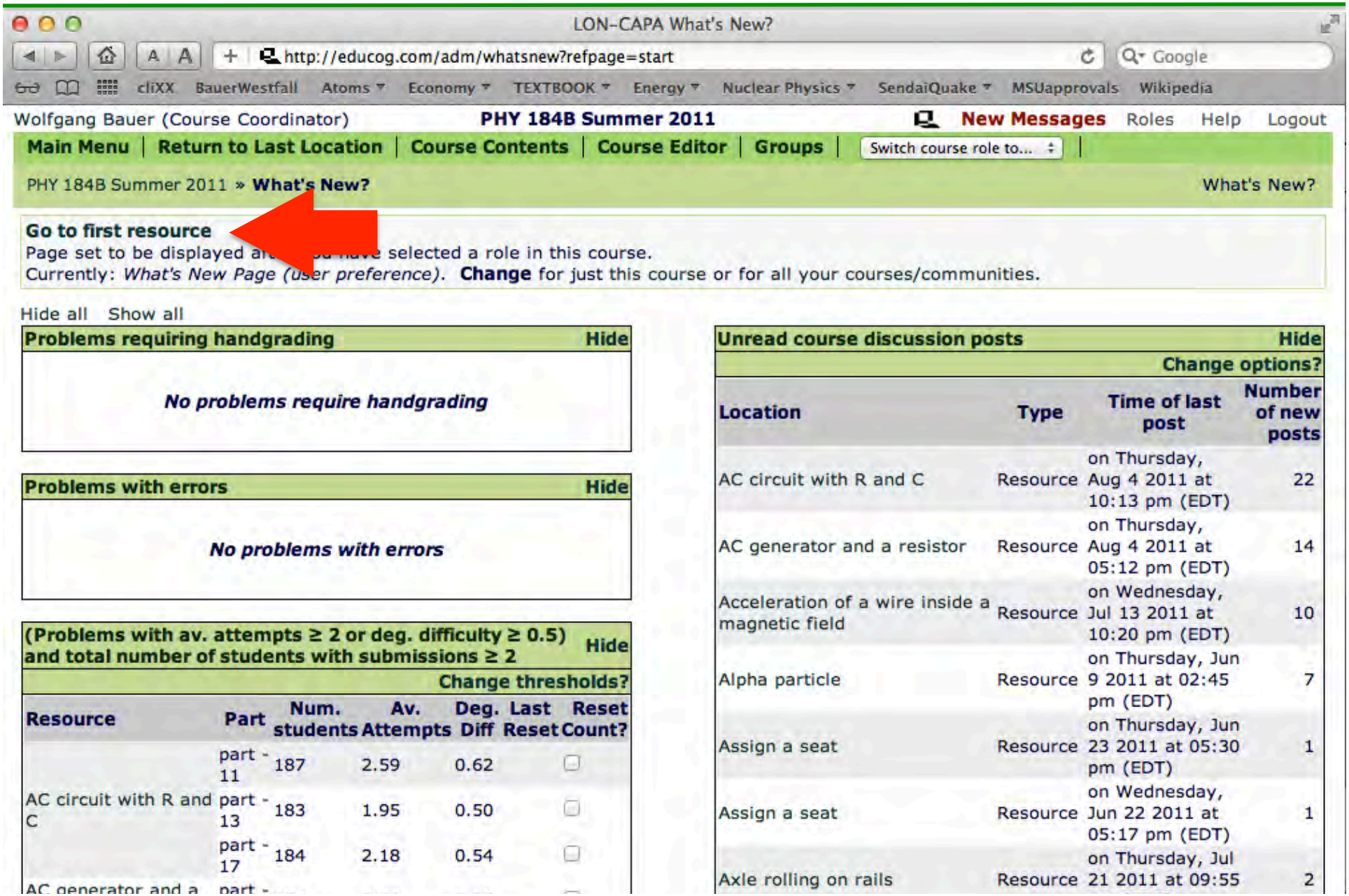


Selected Results: PER on LON-CAPA

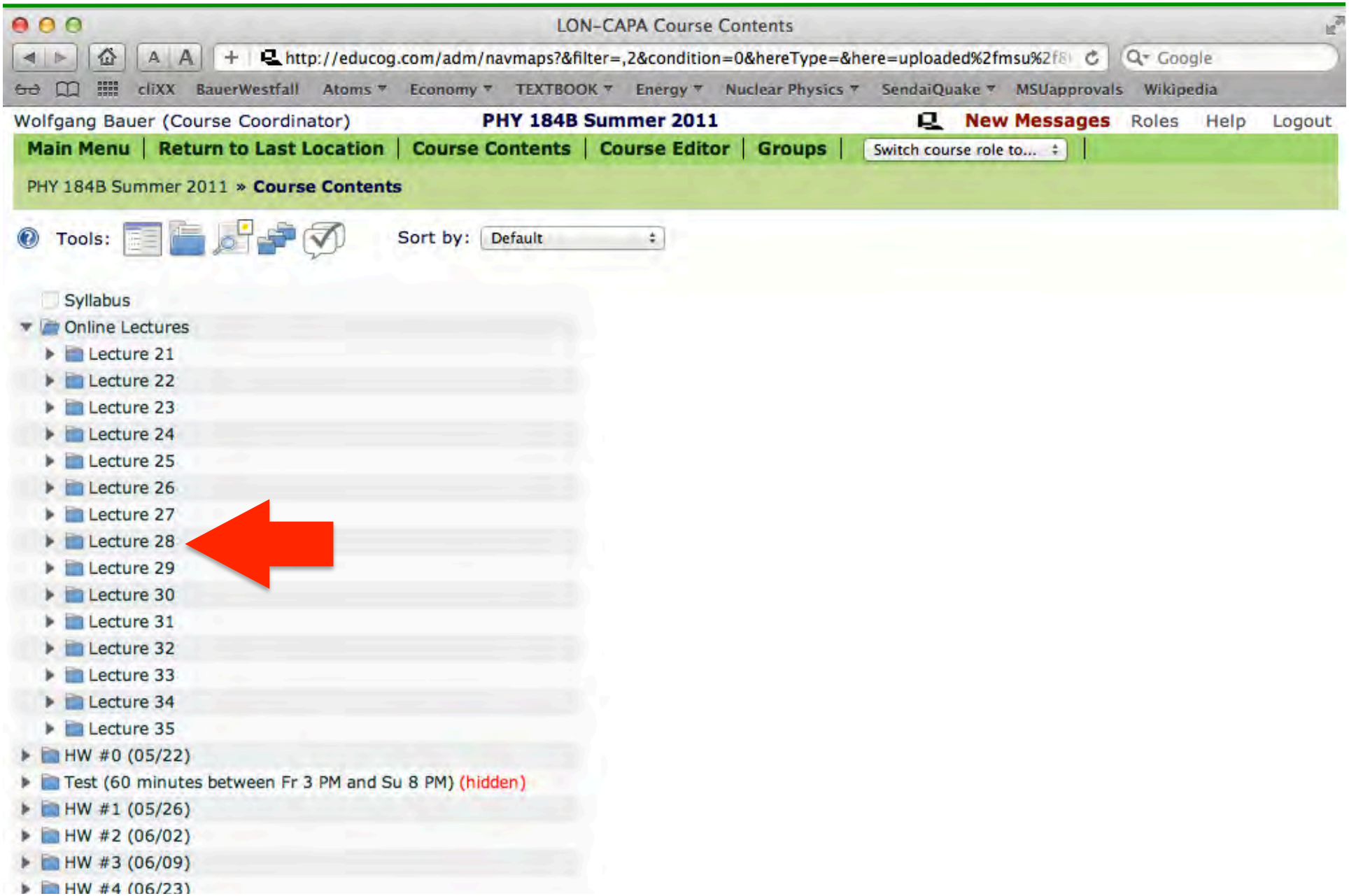
- Females show higher differential improvements than males



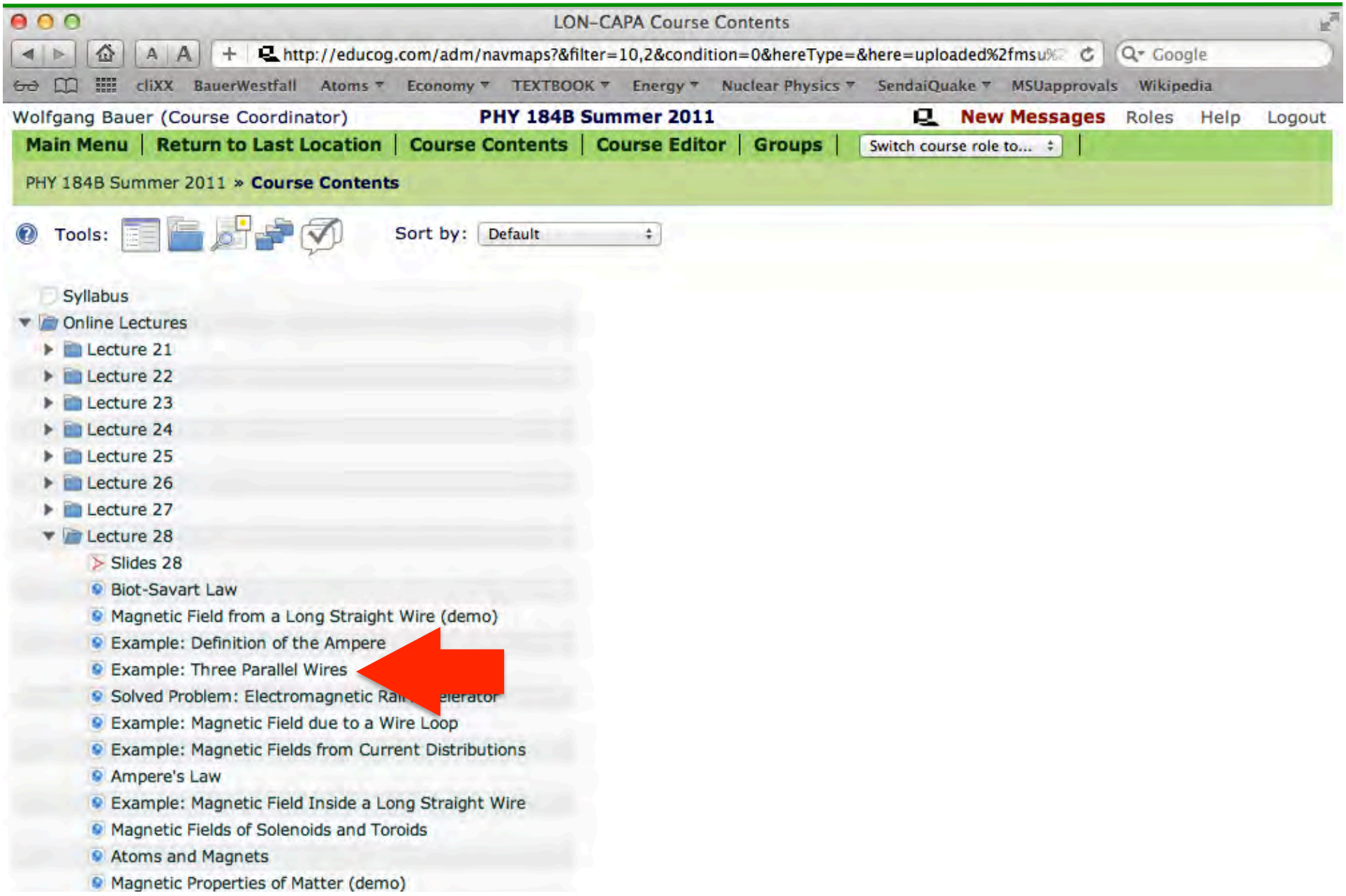
Virtual University Course



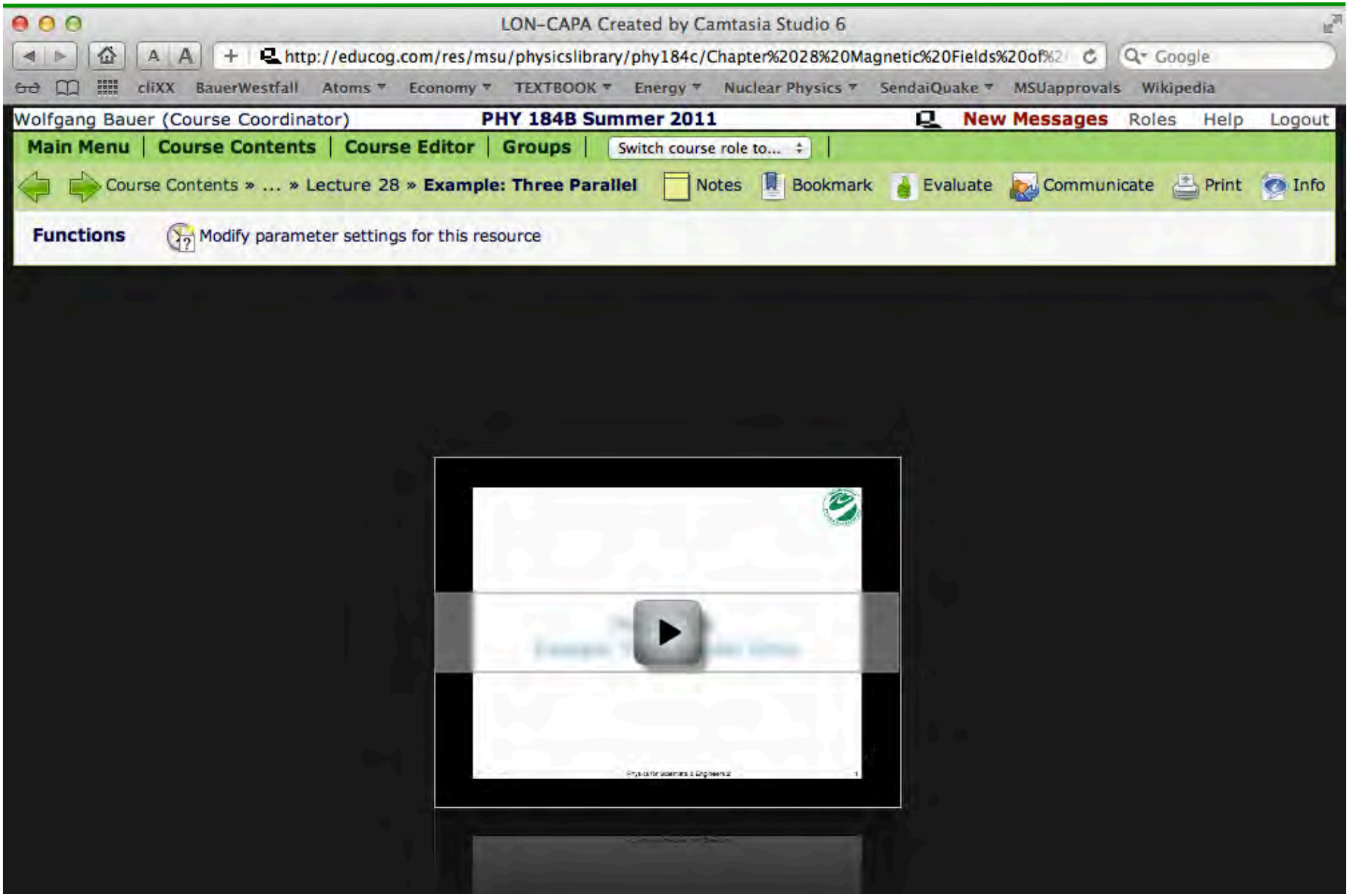
Virtual University Course



Virtual University Course

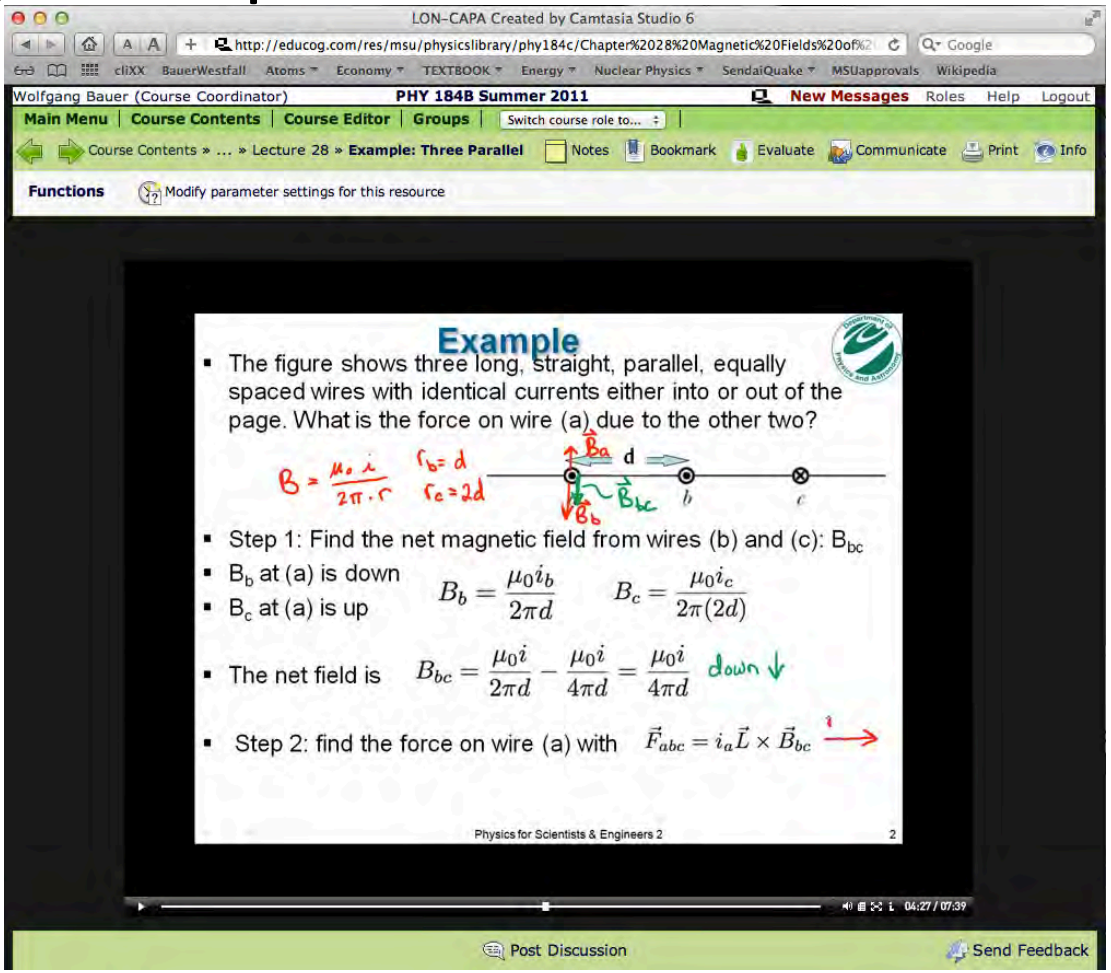


Virtual University Course

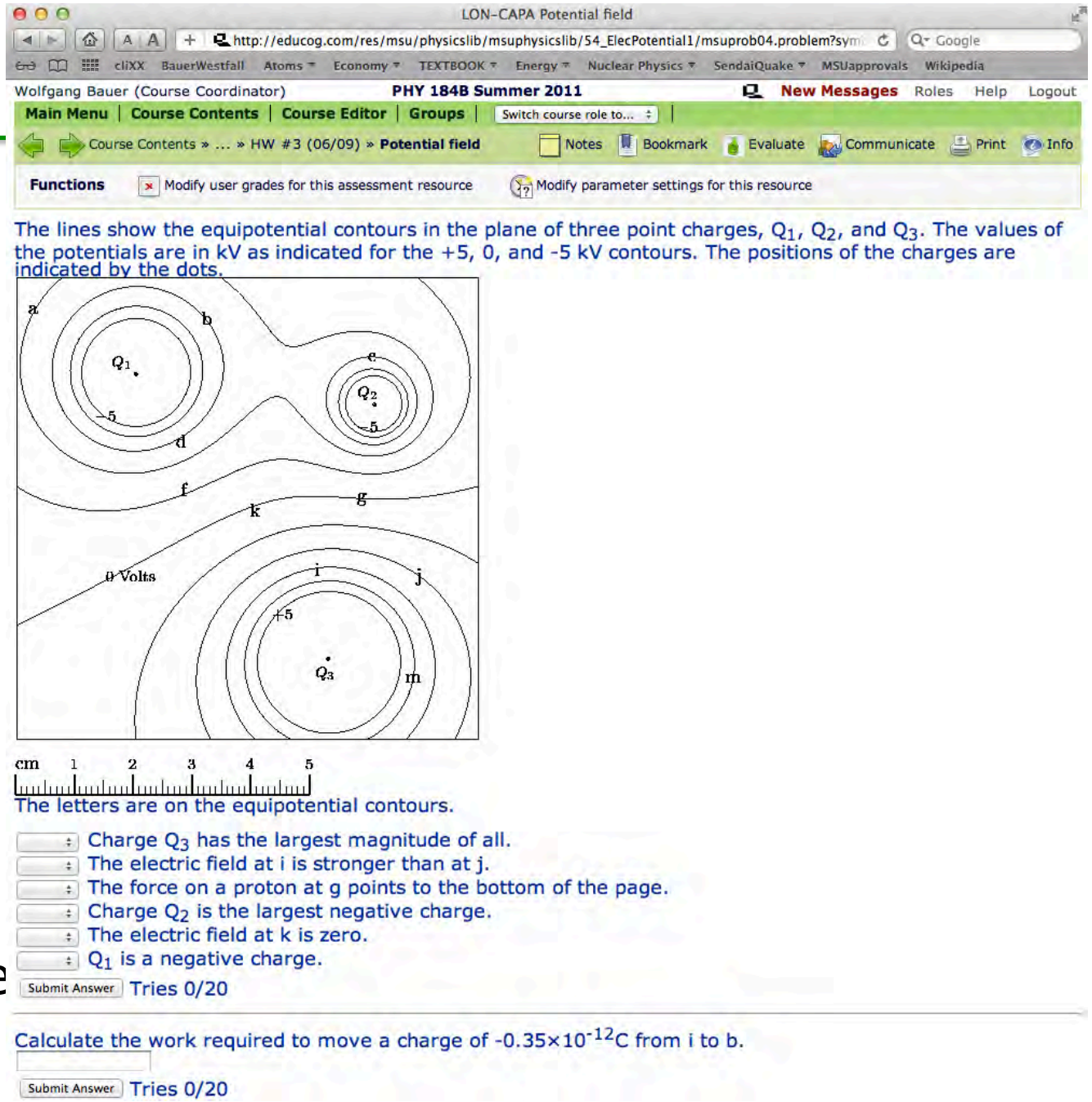


Virtual University Course

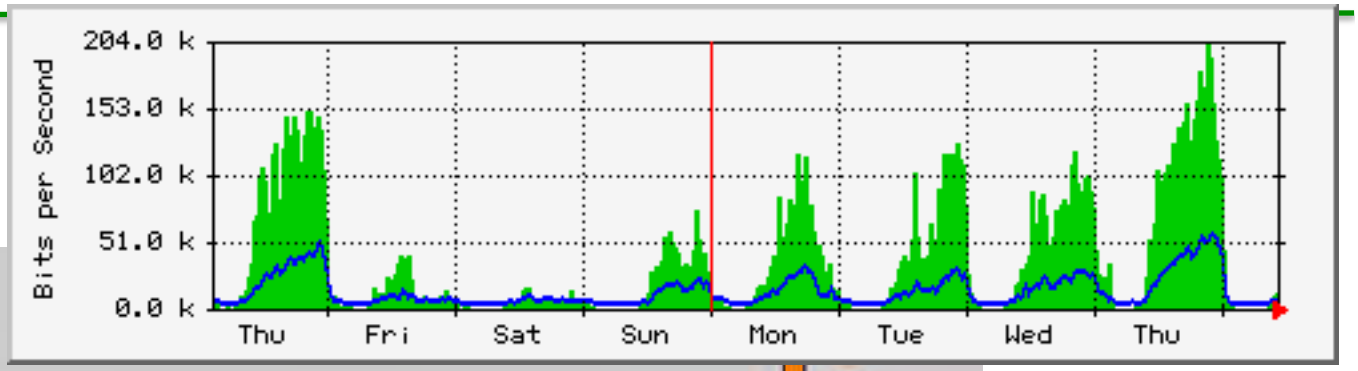
- 5-7 Minute video segments produced w. Camtasia
  - Screen capture
  - Tablet pc with stylus
  - Voiced over
- One-on-one tutoring session
  - Talking head not needed
  - Show what's on the screen

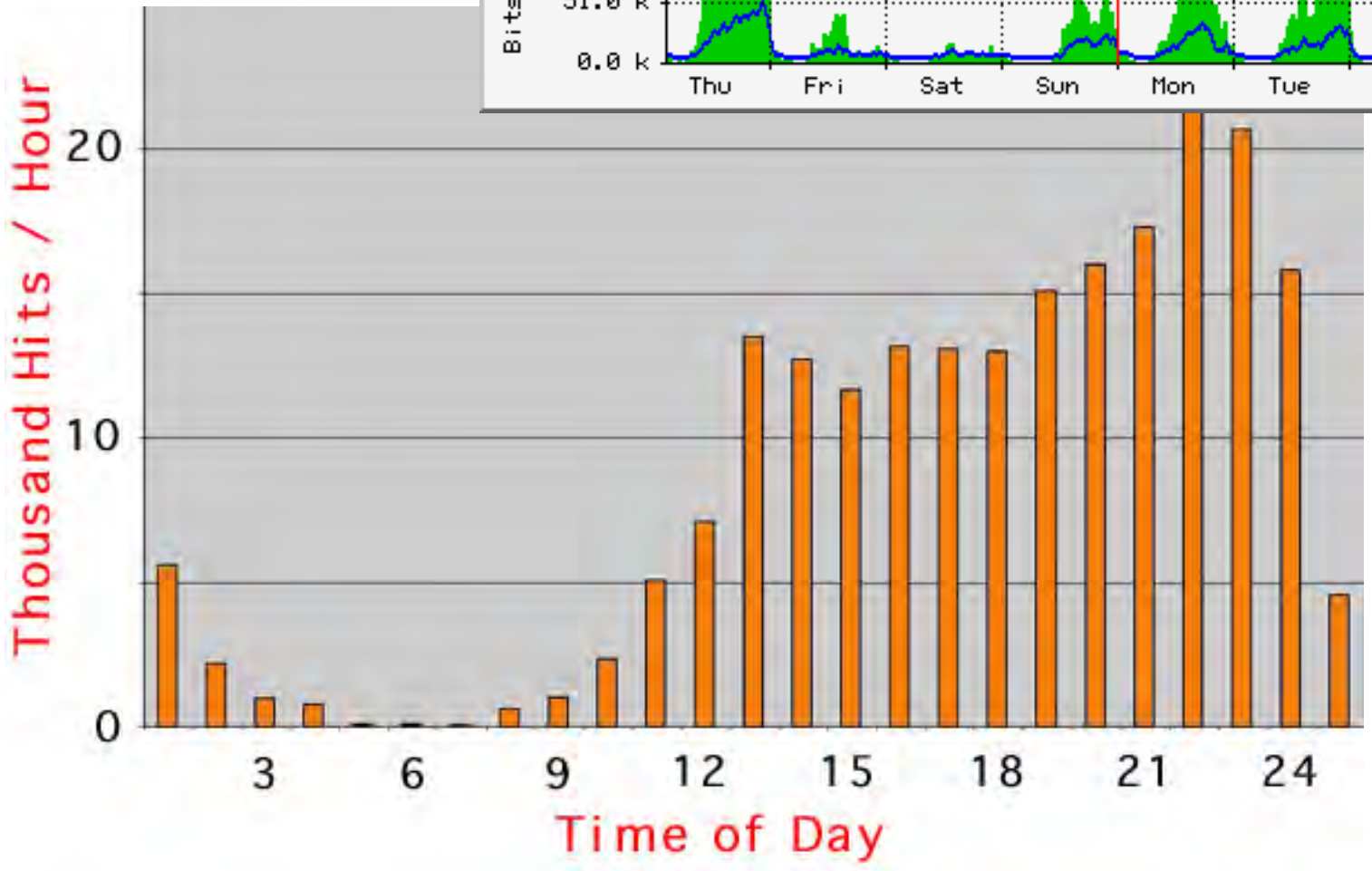


- Homework & Exam Questions
  - Individualized
  - Randomized
  - Computer-graded
- Grade book keeps track
  - Students have full info



When Do Students Work?





Exam Support

STUDENT A

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
if the
9.A
D
G

STUDENT B

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.

ergy

Students receive automatically generated individualized multiple choice exams with their names (and photos).

LON-CAPA machine-grades the bubble sheets.

Exam Support: Re-Takes

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
gether with the voltage source already disconnect

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

1 pt The initial air gap was 8 mm. What is the st
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

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? _____

Submit Answer 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.

Submit Answer Tries 0/2

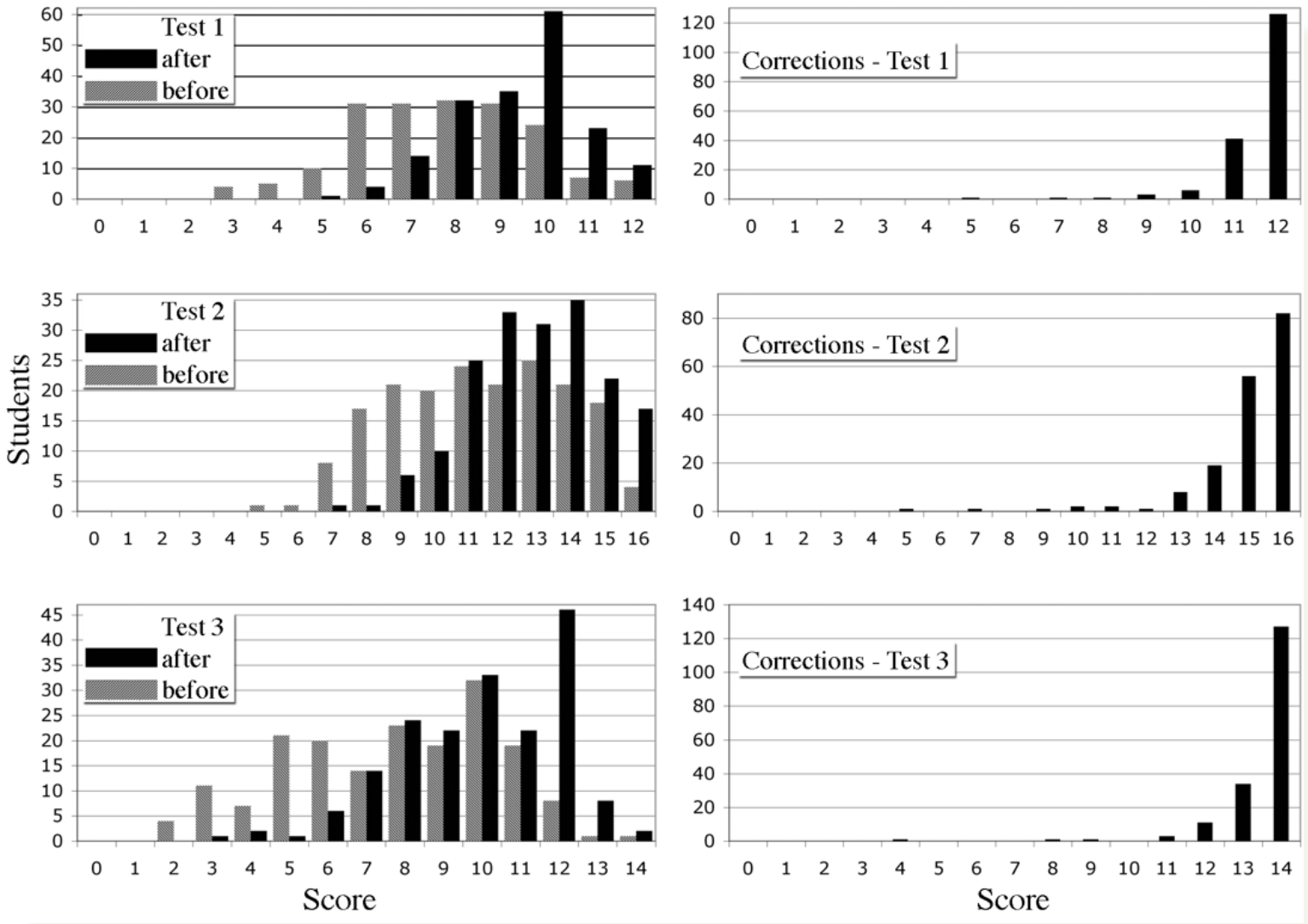
The initial air gap was 5 mm. What is the stored energy if the air gap is now 10 mm?

_____

Submit Answer Tries 0/3

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}

Exam Support: Re-Takes



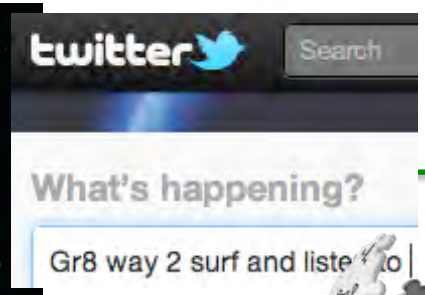
Kortemeyer, Bauer, Benenson, Kashy, The Physics Teacher 44, 235 (2006)

Learning Outcomes

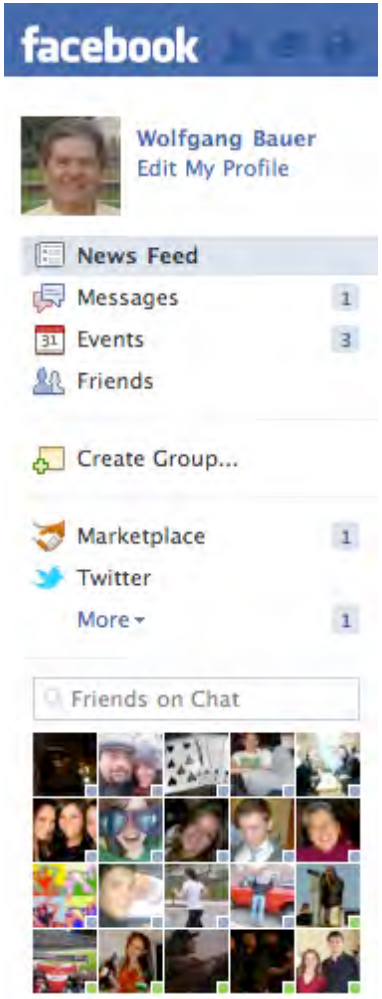
- Comparison study: Taught lecture based PHY231 and compared to VU PHY231c
- Same homework assignments, same exams, same grading system
- Virtual university students scored slightly higher on all three exams and on FCI baseline test, and obtained slightly higher final grades (2.93 vs. 2.87) on average
- One explanation: putting materials on www forces the students to engage in more active learning
- Another: VU students are self-selected group
- Needed: Controlled study

The End of the University as We Know It?

- Brick-and-mortar advantage is slowly vanishing
- Virtual courses offer greater flexibility and broader range
- Formative and summative evaluations are straightforward
  - Cheating can be contained
- Last advantage of the brick-and-mortar university: social interactions
  - Facebook, anyone …



1998: Page, Brin



How our students interact with the world

1994: Andreessen

1989: WWW, Berners-Lee

2007: iPhone (Apple)