Engaging students: E-resources and E-communities

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Agenda

- Courses
- Goals
- Current work
- Future efforts

Courses

- Introduction to Environmental Engineering (CE 280)
- Principles of Environmental Engineering and Science (Civil Eng 2B03)
- Water and Wastewater Treatment Plant Design (CE 483)
- Air Pollution: Science and Engineering (CE489)

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Goals

- Engage students in the classroom
- Address deficiencies in background knowledge
- Create learning communities

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Engaging students in the classroom

- In-class active learning exercises
- Short video clips and tutorials

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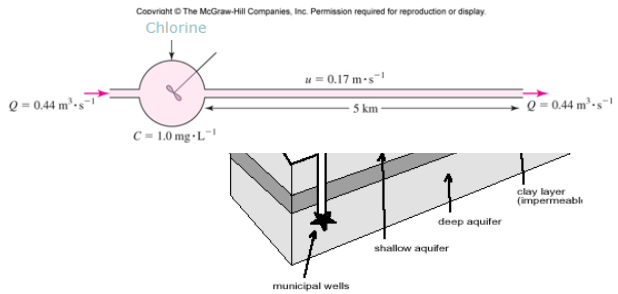
In-class active learning exercises

- Open-ended discussions
- Problem solving
- Structured controversy

Example: Plug flow reactors

The North Bend Water Treatment Plant disinfects their treated water with chlorine. The chlorine concentration in the chlorine contactor (a rapid mix tank) is 1.0 mg/L. Chlorine decays with a rate constant of 0.0037 hr^{-1}. What is the concentration of chlorine at the end of the distribution pipe?



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Short video clips

- Enhance understanding and memory
  - Historical perspective
  - In-class field trips and operation of processes
  - Simulations
    - Water treatment
    - Wastewater treatment
    - Air pollution

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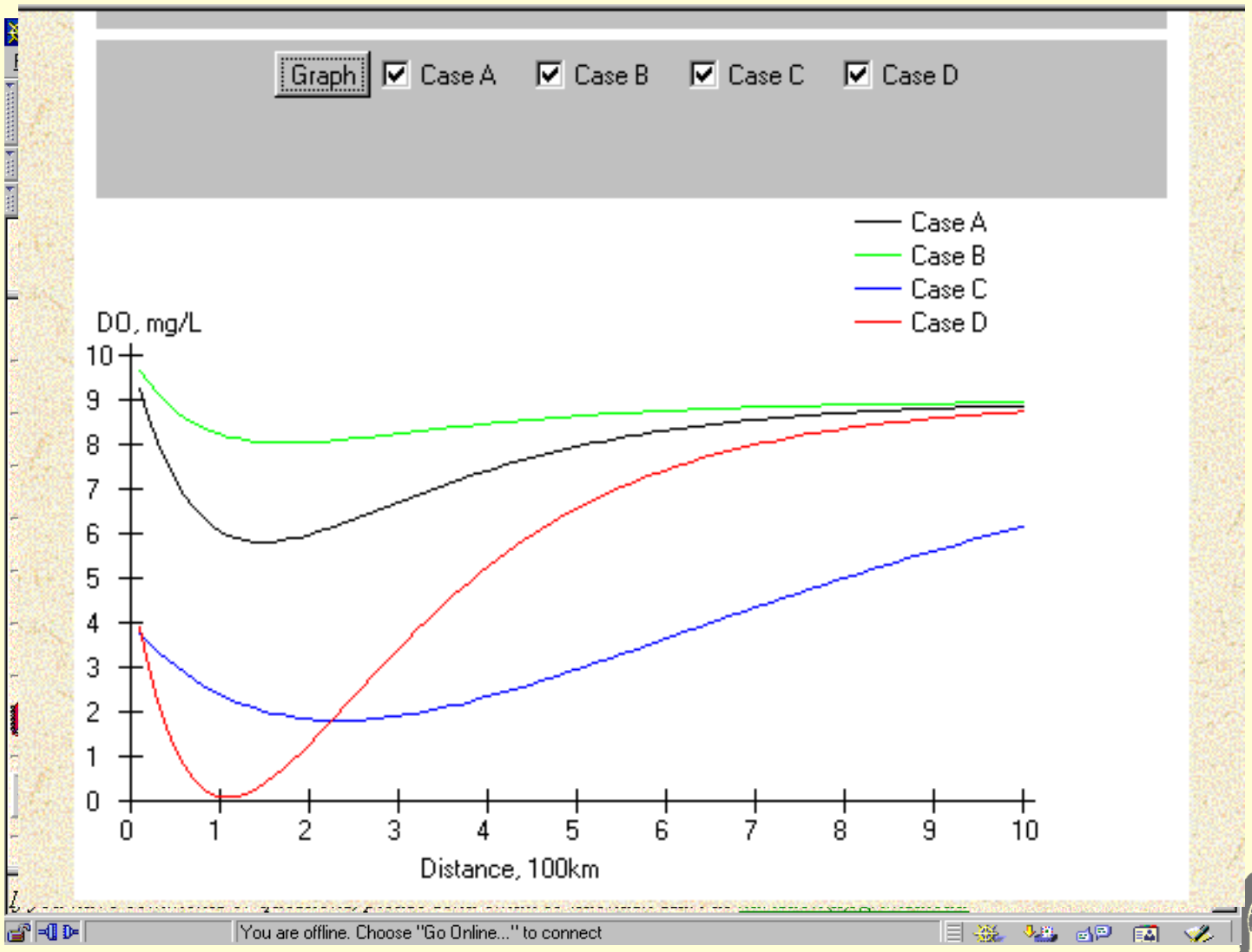
Tutorials

- Addressing deficiencies
  - Lack of recall of material from prerequisite classes
  - Variable backgrounds
  - Use of a significant amount of class time
- Tools
  - In-house generated tutorials
  - Short video clips
    - MERLOT
    - Khan Academy
  - LON-CAPA

Tutorials: Course website



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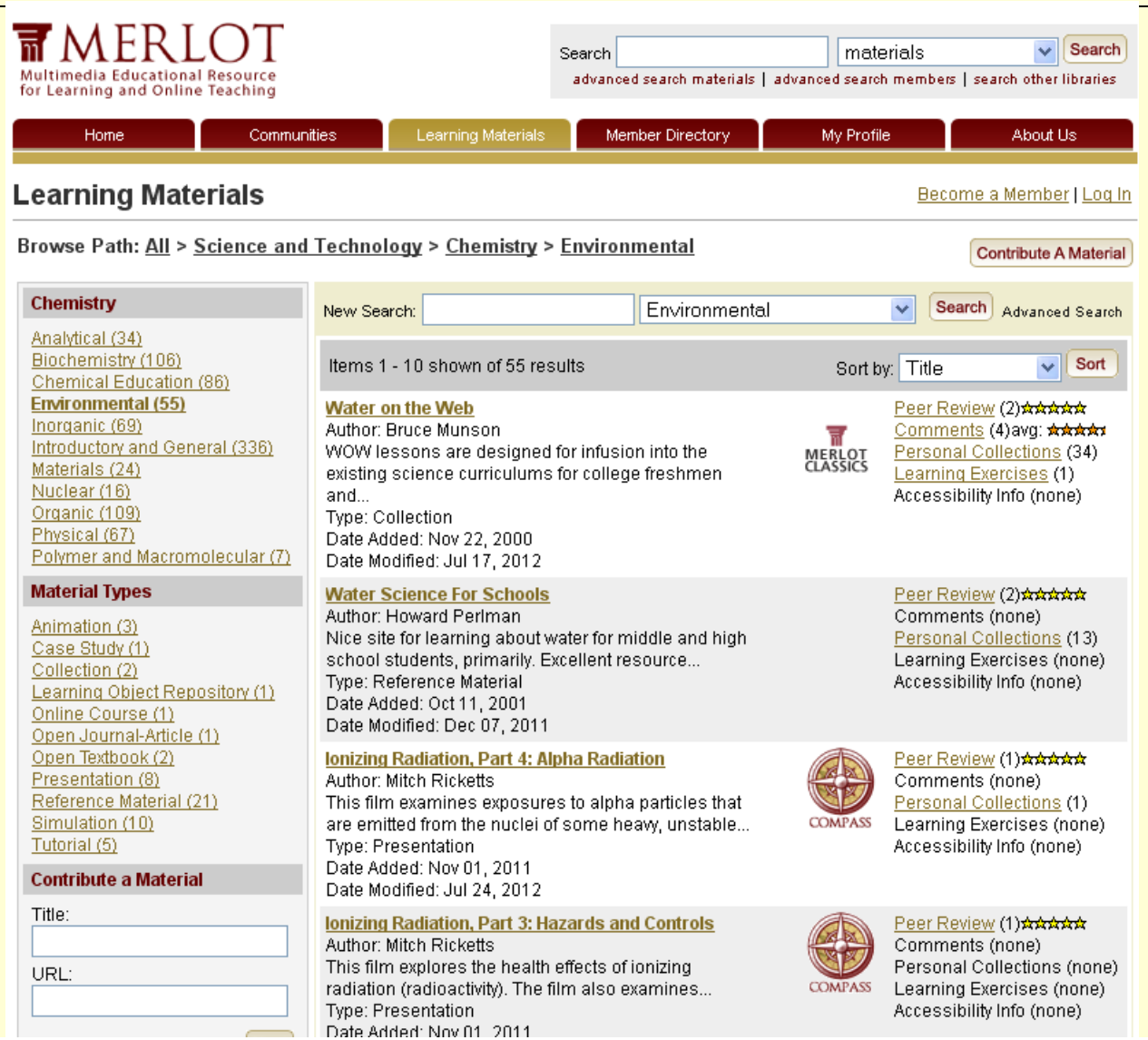
Tutorials: MERLOT



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Tutorials: Khan Academy

Chemistry

Videos on chemistry (roughly covering a first-year high school or college course).

Elements and Atoms
Introduction to the atom
Orbitals
More on orbitals and electron configuration
Electron Configurations
Electron Configurations 2
Valence Electrons
Groups of the Periodic Table
Periodic Table Trends: Ionization Energy
Other Periodic Table Trends
Ionic, Covalent, and Metallic Bonds
Molecular and Empirical Formulas
The Mole and Avogadro's Number
Formula from Mass Composition
Another mass composition problem
Balancing Chemical Equations
Stoichiometry
Stoichiometry: Limiting Reagent
Ideal Gas Equation: PV=nRT
Ideal Gas Equation Example 1
Ideal Gas Equation Example 2
Ideal Gas Equation Example 3

Introduction to Kinetics
Reactions in Equilibrium
Mini-Video on Ion Size
Keq Intuition (mathy and not necessary to progress)
Keq derivation intuition (can skip; bit mathy)
Heterogenous Equilibrium
Le Chatelier's Principle
Introduction to pH, pOH, and pKw
Acid Base Introduction
pH, pOH of Strong Acids and Bases
pH of a Weak Acid
pH of a Weak Base
Conjugate Acids and Bases
pKa and pKb Relationship
Buffers and Hendersen-Hasselbalch
Strong Acid Titration
Weak Acid Titration
Half Equivalence Point
Titration Roundup
Introduction to Oxidation States
More on Oxidation States
Hydrogen Peroxide Correction

Proof: U=(3/2)PV or U=(3/2)nRT
Work Done by Isothermic Process
Carnot Cycle and Carnot Engine
Proof: Volume Ratios in a Carnot Cycle
Proof: S (or Entropy) is a valid state variable
Thermodynamic Entropy Definition Clarification
Reconciling Thermodynamic and State Definitions of Entropy
Entropy Intuition
Maxwell's Demon
More on Entropy
Efficiency of a Carnot Engine
Carnot Efficiency 2: Reversing the Cycle
Carnot Efficiency 3: Proving that it is the most efficient
Enthalpy
Heat of Formation
Hess's Law and Reaction Enthalpy Change
Gibbs Free Energy and Spontaneity
Gibbs Free Energy Example
More rigorous Gibbs Free Energy/ Spontaneity Relationship
A look at a seductive but wrong Gibbs/Spontaneity Proof
Stoichiometry Example Problem 1
Stoichiometry Example Problem 2

Physics

Projectile motion, mechanics and electricity and magnetism. Solid understanding of algebra and a basic understanding of trigonometry necessary.

Normal Force and Contact Force
Normal Force in an Elevator
Inclined Plane Force Components
Ice Accelerating Down an Incline
Force of Friction Keeping the Block Stationary
Correction to Force of Friction Keeping the Block Stationary
Force of Friction Keeping Velocity Constant
Intuition on Static and Kinetic Friction Comparisons
Static and Kinetic Friction Example
Introduction to Tension
Tension (part 2)
Tension in an accelerating system and pie in the face
Moving pulley problem (part 1)
Moving pulley problem (part 2)
Introduction to Momentum
Momentum: Ice skater throws a ball

Fluids (part 2)
Fluids (part 3)
Fluids (part 4)
Fluids (part 5)
Fluids (part 6)
Fluids (part 7)
Fluids (part 8)
Fluids (part 9)
Fluids (part 10)
Fluids (part 11)
Fluids (part 12)
Thermodynamics (part 1)
Thermodynamics (part 2)
Thermodynamics (part 3)
Thermodynamics (part 4)
Thermodynamics (part 5)

Snell's Law Example 2
Total Internal Reflection
Virtual Image
Parabolic Mirrors and Real Images
Parabolic Mirrors 2
Convex Parabolic Mirrors
Convex Lenses
Convex Lens Examples
Concave Lenses
Object Image and Focal Distance Relationship (Proof of Form…
Object Image Height and Distance Relationship
Viewing g as the value of Earth's Gravitational Field Near the S…
Slow Sock on Lubricon VI
Normal Forces on Lubricon VI

[Stoichiometry]

E-communities

- Goals:
  - Facilitate a sense of community
  - Allow students to communicate more effectively outside of class

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E-communities

- Asynchronous Learning using LON-CAPA
  - LON-CAPA allows students and the instructor to interact using a discussion page
  - Students can post questions about homework assignments
  - Other students or the instructor can respond
  - Discussion page serves the same role as a base group, creating e-communities
  - Allows for rapid feedback

E-communities

Calculate the normality of 74.00 µg/L HNO_3

Tries 0/99

Threaded View Chronological View Sorting/Filtering options Export?

Hide Delete Reply Submissions (Tue Sep 6 10:43:43 am 2011 (EDT))

Essentially this is the same molarity, except for normality you divide the calculated molarity by an equivalency factor(Feq).

The equivalency factor is found by discovering how many moles of the given solution is needed to form 1 mole of H+

HNO3 example. it takes 1 mole of HNO3 to form 1 mole H+ so the Feq = 1.

H2SO4 example. It takes .5 moles of H2SO4 to form 1 mole of H+ so the Feq = .5

Hide Delete Reply Submissions (Tue Sep 6 01:44:13 pm 2011 (EDT))

Another way to think about this is with the number of equivalents. Because 1 mole of nitric acid completely dissociates to release one more of H+, the number of equivalents (n) = 1. Since the equivalent weight = the molecular weight/n the equivalent weight is equal to the molecular weight.

With sulfuric acid, 2 moles of H+ are released when one mole of sulfuric acid completely dissociates. Then n = 2 and the equivalent weight = molecular weight/2.

As such the normality of sulfuric acid is twice the molarity, but the normality of nitric acid equals its molarity.

The concentration of NO_2 was determined to be 136.70 µg/m^3 at 11.5 °C and 133.00 kPa pressure. What is the concentration of NO_2 in units of ppm?

Tries 0/10

Threaded View Chronological View Sorting/Filtering options Export?

NEW **[Anonymous 1]** Hide Delete Reply Submissions (Tue Apr 19 09:20:05 am 2005 (EDT))

I thought ppm was the same thing as mg/L. Or do you have to take into account pressure etc.

NEW **Re: Susan Masten (masten:msu)** Hide Delete Reply Submissions (Tue Apr 19 11:37:10 am 2005 (EDT))

ppm = mg/L for dilute solutions in water but not for air.

E-communities

Lansing Board of Water and Light - Dye Water Treatment Plant Tour

Task

Tuesday, September 20th
If you are carpooling, meet at 10:15 at the circle drive on the west side of the Engineering Building, off Red Cedar Road. We are expected at the plant at 10:30.

If you are taking the #1 bus, take the bus to the stop closest to Museum Drive. Walk down to the end of Museum Drive (about a 3 min walk)

Directions:
West on Michigan Avenue
Left on Museum Drive (just beyond the intersection with Cedar St.)

You may park in the LBWL parking lot that is located at the end of Museum drive and is pretty much directly across from ReOlds museum parking lot entrance.
Someone will meet the class in the parking lot and bring them up into the plant.

If you are able to drive, please let me know - by indicating your name and the number of passengers you are able to take. If you are driving, please be in the Circle Drive off Red Cedar Road near the Engineering Building by 10:15 on Thursday.

Threaded View Chronological View Sorting/Filtering options Export?

I can drive. Hide Delete Reply (Tue Sep 13 10:00:58 pm 2011 (EDT))

my name is I will drive and i can have 6 on my car + me.

Driving Hide Delete Reply (Wed Sep 14 03:17:20 pm 2011 (EDT))

I can drive myself plus 3 or 4 others

Going by bicycle Hide Delete Reply (Fri Sep 16 05:34:55 pm 2011 (EDT))

This is and I will be riding my bike to the plant. I live close by.

Re: Going by bicycle **Susan Masten (masten:msu)** Hide Delete Reply (Mon Sep 19 08:54:30 am 2011 (EDT))

Thanks for letting me know, . Hopefully the weather tomorrow will be better than today.

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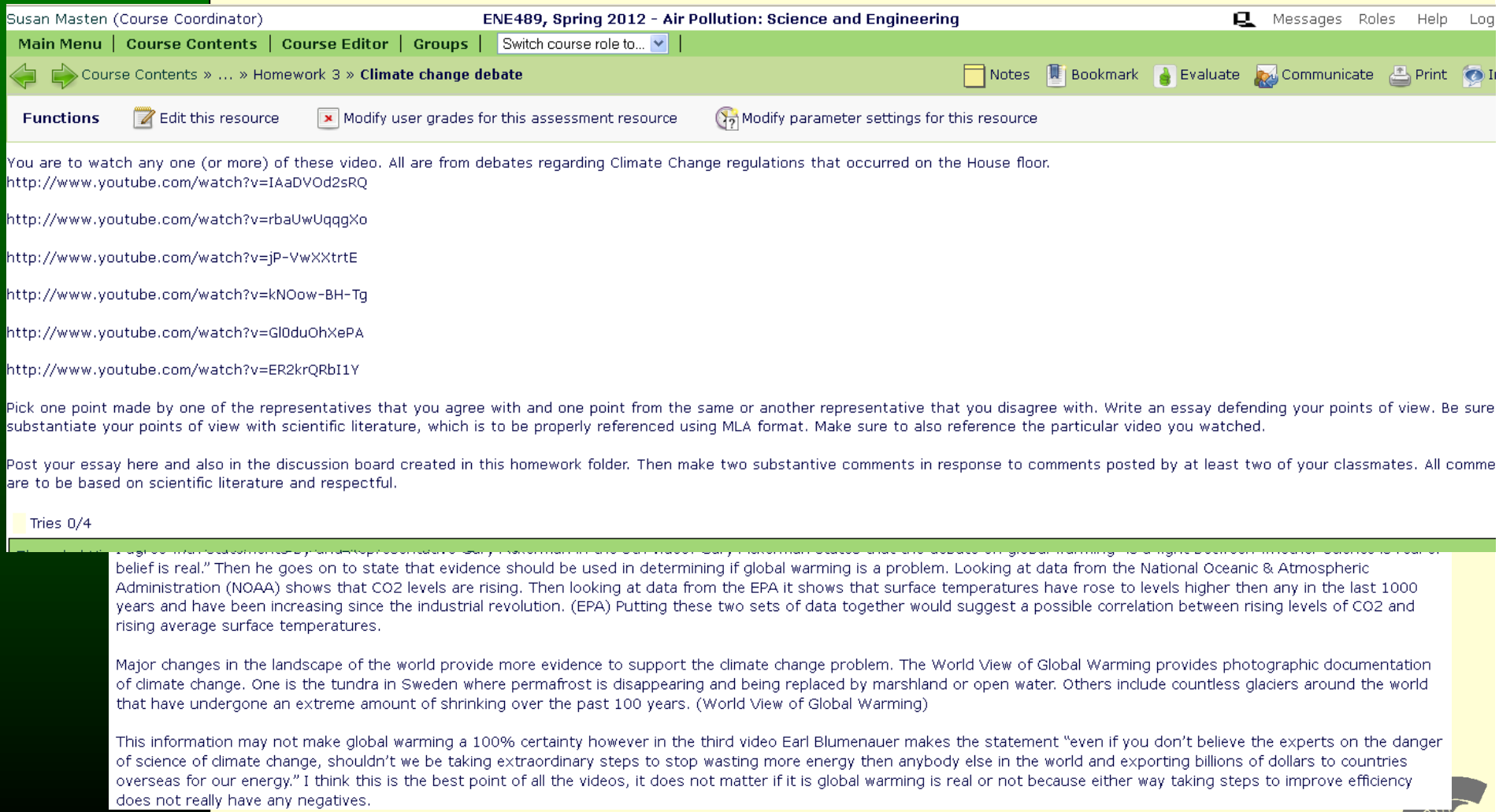
LON-CAPA e-communities



Susan Masten (Course Coordinator) ENE489, Spring 2012 - Air Pollution: Science and Engineering Messages Roles Help Log

Main Menu | Course Contents | Course Editor | Groups | Switch course role to... |

Course Contents » ... » Homework 3 » **Climate change debate** Notes Bookmark Evaluate Communicate Print

Functions Edit this resource Modify user grades for this assessment resource Modify parameter settings for this resource

You are to watch any one (or more) of these video. All are from debates regarding Climate Change regulations that occurred on the House floor.
http://www.youtube.com/watch?v=IAaDVOd2sRQ

http://www.youtube.com/watch?v=rbaUwUqqgXo

http://www.youtube.com/watch?v=jP-VwXXtrtE

http://www.youtube.com/watch?v=kNOow-BH-Tg

http://www.youtube.com/watch?v=Gl0duOhXePA

http://www.youtube.com/watch?v=ER2krQRbI1Y

Pick one point made by one of the representatives that you agree with and one point from the same or another representative that you disagree with. Write an essay defending your points of view. Be sure substantiate your points of view with scientific literature, which is to be properly referenced using MLA format. Make sure to also reference the particular video you watched.

Post your essay here and also in the discussion board created in this homework folder. Then make two substantive comments in response to comments posted by at least two of your classmates. All comme are to be based on scientific literature and respectful.

Tries 0/4

belief is real." Then he goes on to state that evidence should be used in determining if global warming is a problem. Looking at data from the National Oceanic & Atmospheric Administration (NOAA) shows that CO2 levels are rising. Then looking at data from the EPA it shows that surface temperatures have rose to levels higher then any in the last 1000 years and have been increasing since the industrial revolution. (EPA) Putting these two sets of data together would suggest a possible correlation between rising levels of CO2 and rising average surface temperatures.

Major changes in the landscape of the world provide more evidence to support the climate change problem. The World View of Global Warming provides photographic documentation of climate change. One is the tundra in Sweden where permafrost is disappearing and being replaced by marshland or open water. Others include countless glaciers around the world that have undergone an extreme amount of shrinking over the past 100 years. (World View of Global Warming)

This information may not make global warming a 100% certainty however in the third video Earl Blumenauer makes the statement "even if you don't believe the experts on the danger of science of climate change, shouldn't we be taking extraordinary steps to stop wasting more energy then anybody else in the world and exporting billions of dollars to countries overseas for our energy." I think this is the best point of all the videos, it does not matter if it is global warming is real or not because either way taking steps to improve efficiency does not really have any negatives.

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E-communities:

- Facebook groups

http://www.huffingtonpost.com/2012/07/24/greenland-ice-melt-nasa_n_1698129.html?utm_hp_ref=fb&src=sp&comm_ref=false

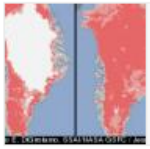

IMAGE: Unprecedented Greenland Ice Melt Stuns NASA Scientists

www.huffingtonpost.com

Unprecedented melting of Greenland's ice sheet this month has stunned NASA scientists and has highlighted broader

Like · Comment · Unfollow Post · Share · 6 hours ago

The Sierra Club is still looking for people who might be interested in doing a Political Internship for the Summer or Fall.

For the Summer, they are specifically looking for interns from Oakland, Macomb, St. Clair, Washtenaw, and Wayne Counties.

For the fall, Sierra Club need interns from all locations.

Send me a message for more information or send your resume to Mike Berkowitz at mike.berkowitz@sierraclub.org, with a brief (one-two paragraphs) statement describing your interest in this internship.

Like · Comment · Follow Post · June 5 at 7:42am

The East Michigan Chapter now has a LinkedIn group! Search for AWMA - East Michigan Chapter and request to join so that you can follow what is going on at through the professional chapter. There will be a networking event on June 27th for recent graduates (and soon to be graduates)...check out the LinkedIn group for more information.

Like · Comment · Unfollow Post · June 2 at 9:30pm

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Current and Future Work

- Development of short modules (lessons) to provide tutorial material
- Continued development of LON-CAPA problems, with integration of multimedia tutorials
- Use of interactive problems/debates with LON-CAPA
- Continued assessment
- Collaboration across universities

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Questions

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Acknowledgements

- Funding:
  - GE Fund
  - Department of Education: Graduate Assistantships in Areas of National Need
  - Michigan State University
- Colleagues at MSU
  - Prof. James Fairweather, College of Education
  - Prof. J.D. Fisher, Dept. of Electrical Engineering
  - Prof. G. VanDusen, former Assistant Dean of Undergraduate Education, College of Engineering
  - Prof. Thomas Wolff, Associate Dean, MSU
  - Prof. Jon Sticklen, CEER, MSU
  - Prof. Gerd Kortemeyer, Lyman Briggs and LON-CAPA, MSU

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Web-based quizzes

- Goals
- Mechanics
  - Quizzes opened for five days
  - Students could log on, print quizzes, solve problems and submit answers
  - Once answers submitted, quiz was locked
  - Students could track performance on line
- Assessment
  - 49% students stated that quizzes occasionally or never “aided their learning of course material”
  - Many had trouble remembering due dates

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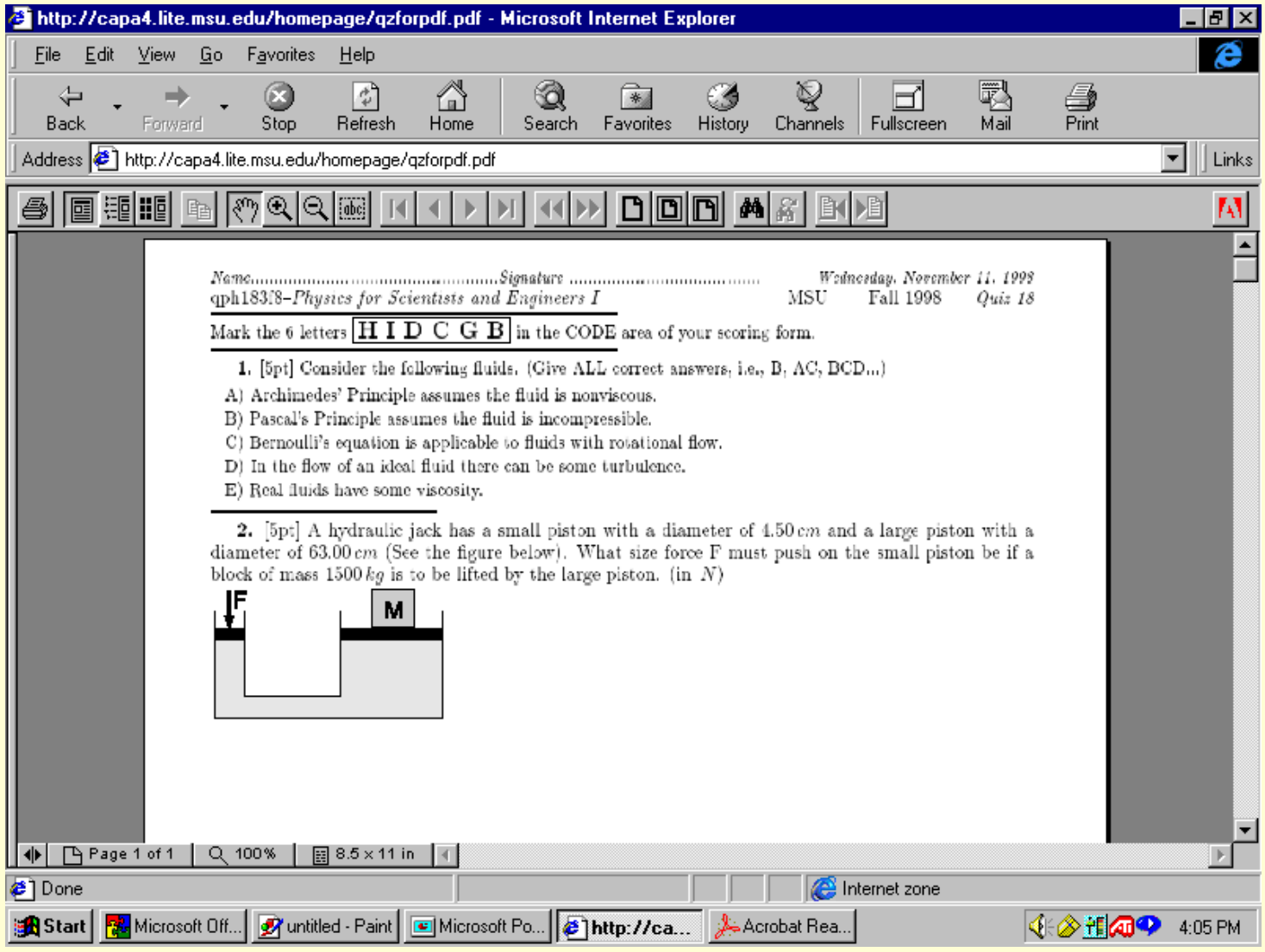
LON-CAPA

- Mechanics
  - Developed by Physics Department at MSU
  - Supported by MSU and National Science Foundation grants
- Homework assignments
  - Weekly individualized assignments
  - Multiple attempts allowed
  - Multiple choice, problems, fill-in, matching
  - Link or tags can be provided for help

LON-CAPA: Computer Assisted Personalized Approach



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LON-CAPA: Computer Assisted Personalized Approach

- Monitoring performance
  - During the semester, the instructor could access multiple statistical information - including assessment of class and individual performance on particular problems or the entire set.
  - Can track student submissions, entire course record

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LON-CAPA: Computer Assisted Personalized Approach

- Assessment
  - 66% agreed or strongly agreed that “the use of CAPA aided my learning of course material”.
  - Only 16% disagreed or strongly disagreed with this statement.
  - More students responded that they often or very often attended office hours (2001: 44% vs.2000: 17%)
  - More of the class felt that material was graded fairly (2001: 71%, 2000: 53%, 1999:66%)

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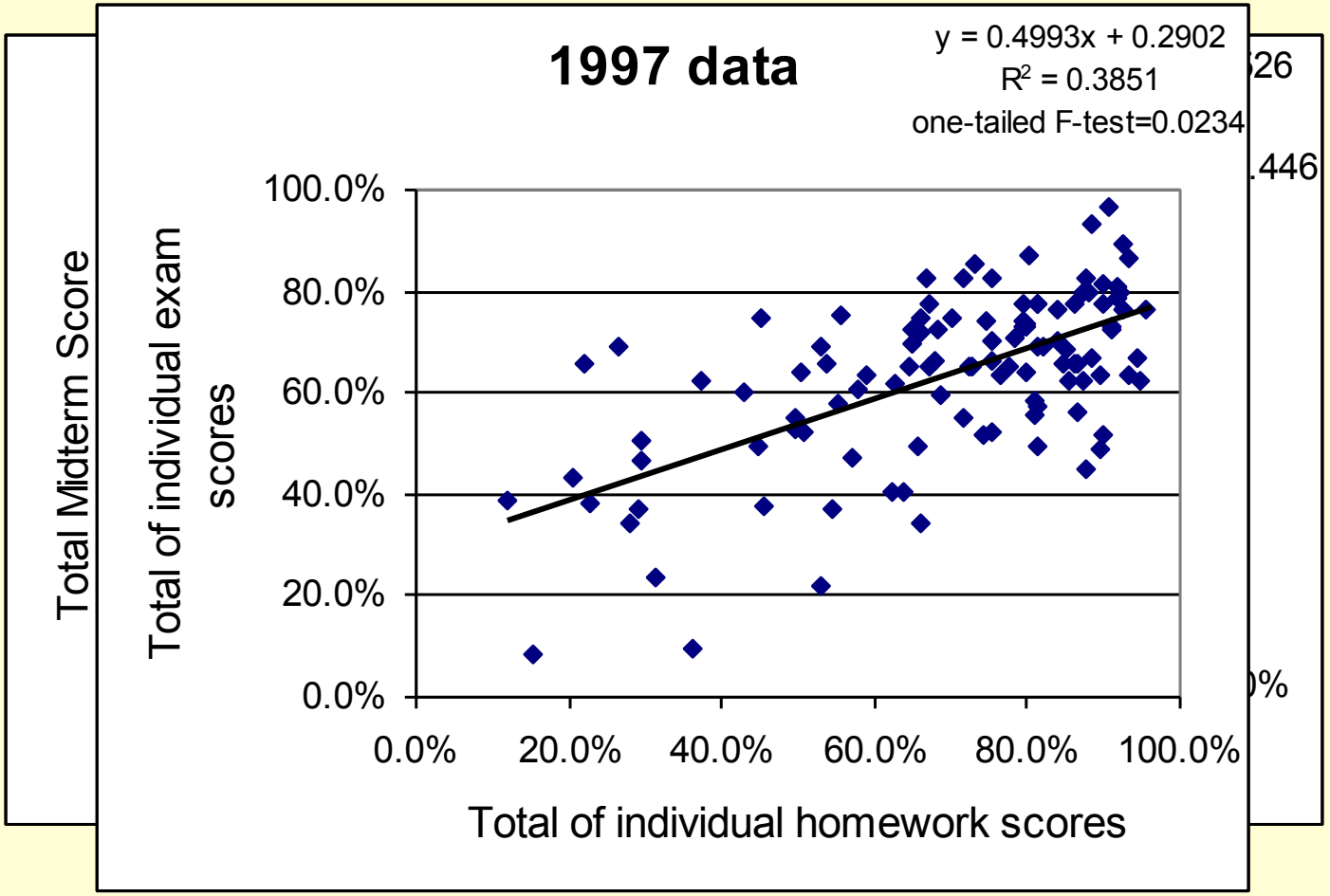
LON-CAPA: Computer Assisted Personalized Approach

- Assessment
  - Students expect to earn 100% on homework assignments
  - They will continue trying problems and get frustrated if they cannot get the correct answer
  - Homework grades not well correlated with exam grades

LON-CAPA: Computer Assisted Personalized Approach

- Assessment



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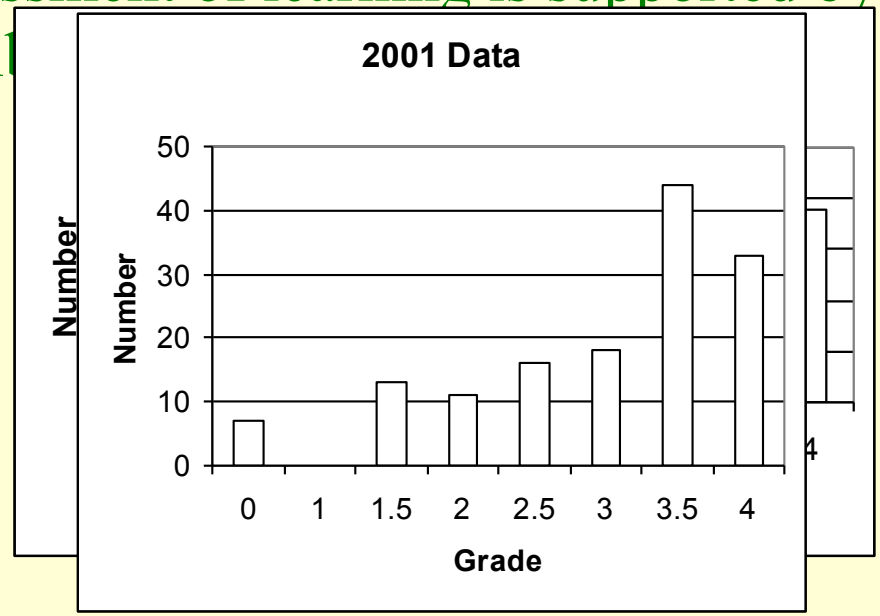
LON-CAPA: Computer Assisted Personalized Approach

- Assessment of learning
  - 76% of the students strongly agreed or agreed that LON-CAPA assignments added their learning
  - Only 16% disagreed or strongly disagreed
  - Assessment of learning is supported by grade distri



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Current and Future Work

- Assist other faculty with development of CAPA for other engineering courses
  - medium-sized classes (Fluid Mechanics)
  - Study Abroad Program (Statics, Dynamics and CE 280)
- Comparative evaluation of traditional model and cooperative learning model for CE280
- Longitudinal studies to evaluate student learning in service courses over time
- In-depth interviews with stakeholders

Conclusions

- The use of active learning (including LON-CAPA) gave students a greater role in the learning process
- Students did not take advantage of all material available unless there was some incentive to do so
- Video clips aided student learning but there needs to be a better repository and peer review
- LON-CAPA can be used to assist students to learn material and track performance

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