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Integration of Technology Into Undergraduate Education via Cross-Disciplinary Pollination

Nancy Kerner, Brenda Gunderson and Emily Bonem, Adena Rottenstein, Gracie Winschel and Others, University of Michigan at Ann Arbor
Project Goal

To improve education by integrating quality cross-discipline and course-specific Learning Objects (LOs) into undergraduate courses.

Learning Resources
Any web-based teaching tool (tutorial, collection, ....)

Learning Objects (LOs)
Interactive web resources that lead students to learning goals via informed pedagogy.
Academic Gateway Courses
Initial Perceived Barriers to using technology in teaching or learning

Don’t know how to implement
Extra work, little connection
Takes too much time
I spend too much time on it
Students don’t know how to use it
Don’t have tech support
Too complicated
Too expensive
I don’t have the skills
Doesn’t work on my computer

carat.umich.edu/carat/itsurs/2005_survey
The Proposed Solution
Train (Graduate) Students

• Educate (graduate) students across disciplines to access, evaluate, design LOs; and to create quality course-specific and cross-discipline LO collections.
• (Graduate) students disseminate LOs to relevant faculty for integration into undergraduate courses

The trainee becomes the trainer

See “Bottom Up Faculty Development” at conference.merlot.org/2009/Sat_Program.html
The Proposed Solution
Unique Collaborative Approach

Project Faculty Mentors
- Coordinators/instructors of large gateway courses.
- Guidance on best practices to enhance teaching/learning

Graduate Student Instructors
- Interest in tech + pedagogy
- Train to find, evaluate, package, author online LOs

Other Faculty
- Provide schedule of topics and concepts
- Provide insight on muddy points and desirable LOs

Staff
- Provide basic grant support
- Some technology support

Initial year = General Chemistry, Psychology, Statistics with promise to add additional disciplines.
The Proposed Solution
Determine Faculty Needs/Preferences

- What are the difficult concepts?
- Syllabus topics?
- Type of LO preferences?
The Funded Project!

- Enhancing Undergraduate Education Through the Deployment of Quality Learning Objects (2008-2010)

- Infusing Curricula with Adaptable Learning Objects to Improve Student Engagement and Learning (2011-2013)

Funding

NINI Grant (New Initiatives/New Infrastructure) from UM LSA-ITC (Instructional Tech Committee)
MELO3Ds
Michigan Education Through Learning Objects

General Chemistry, Psychology, Statistics, Physics, Physical Chemistry, Math, Writing, Spanish, Organic Chemistry, History (Disciplines Years 1-3)
• **LO course collection**
  – Selection based on course needs and goals
  – Located in MERLOT as Personal Collection
  – Provided within syllabus or on website

• **LOs tagged for course integration**
  – Choice based on **needs vs type** of LO
  – Choice focused on LOs that address **difficult concepts or skills**
Periodic Table Scavenger Hunt

TEAM #: __________  NAMES: __________________________

I. Electronic Structure of Elements

Procedure
You are to use the Internet Web site http://www.dayah.com/periodic/ to determine structural properties of elements. At this site, you will find an interactive Periodic Table that will be helpful as you answer the following questions. You may have to click on various tabs to locate the correct information. Explore the site a bit before starting.

Periodic Table Information
• Family = column of elements
• Period = row of elements

1. Record the symbol of the element with an electron configuration of 1s²2s²2p¹? _____
   What is the symbol of the element that has one additional valence electron in the outer electron energy level? ______

2. What is the family number with elements having a full valence s subshell and only 1 electron in the p subshell? _____
   The symbol and electron configuration for the element in Period 2 of this family = ___________________________

3. Circle the energy level ( 1 2 3 4 ) that elements in Period 2 are adding valence electrons to.

4. K, Ca, Ga, and Br are members of the same ( family period ) = number ________ where electrons are being added to energy level ( 1 2 3 4 ).

5. F, Cl, Br, and I are members of the same ( family period ) = number ________ where each element has ( 1 2 ) electrons in the ( s p ) shell
Psych MELO Summary
Students in a single section recommend many quality LOs previously overlooked or undiscovered

Examples

**Pavlov’s Dog**- A classical conditioning simulation
Cataloged in: [Science & Technology/Biology/Zoology](#)

**Mouse Party**- A simulation for examining the effect of common illicit drugs at the synaptic level
Cataloged in: [Science & Technology/Chemistry/Biochemistry](#)
Initial Cross-Disciplinary Pollination

Psychology

Show and Tell
Pollination Outcome

Innovative LO Collection Building in Large Course

Chem 125 Learning Object Hunt!

SUBMIT COMPLETED FORMS TO: chem125hunt@gmail.com

Hello everyone!

This is a site dedicated to Learning Objects relating to the Chemistry 125/126 course at the University of Michigan, specifically online learning objects. An Online Learning Object is a web-based digital resource that can be used repeatedly to enhance learning and support teaching of a given subject matter. There is a link to the MERLOT website which has an ever-increasing collection of links to submitted learning objects dealing with material from nearly every subject. Currently we are looking to involve the Winter 2010 class in a learning object scavenger hunt, where students can search the internet to find QUALITY learning objects. Once a learning object is submitted, it will be posted to this website, and will no longer be able to be submitted. There are also current learning objects on this site which can help you with the content of the course.

To submit a website, please review the "Learning Object Hunt Information" and then fill out the "Learning Object Submission Form" found to your left, and submit it to chem125hunt@gmail.com

Everyone that submits a website can earn up to 3 additional GSI points, and be in the running to receive 10 additional points for the best site (as chosen by you)! You will have until the April 9th to submit a website. Keep in mind that it can deal with any of the

http://www.screencast.com/t/MTE1MG14MTgt
SUBMIT COMPLETED FORMS TO: chem125hunt@gmail.com

Hello everyone!

This is a site dedicated to Learning Objects relating to the Chemistry 125/126 course at the University of Michigan, specifically online learning objects. An Online Learning Object is a web-based digital resource that can be used repeatedly to enhance learning and support teaching of a given subject matter. There is a link to the MERLOT website which has an ever-increasing collection of links to submitted learning objects dealing with material from nearly every subject. Currently we are looking to involve the Winter 2010 class in a learning object scavenger hunt, where students can search the internet to find QUALITY learning objects. Once a learning object is submitted, it will be posted to this website, and will no longer be able to be submitted. There are also current learning objects on this site which can help you with the content of the course.

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Move from a model where students are not only learners but also co-teachers?
Perceived Barriers Alter!
to using technology in teaching or learning

Quality online learning objects that address key course concepts do NOT exist!
Example Outcome
Innovative LO Designs

A New Interactive and Entertaining Redox Applet

Chemistry Cage Match: The Battle For The Electron

Learning Objective: To understand the principles of Redox in terms of a variety of chemical properties
**Example Outcome**

**Authored LO (Statistics)**

### Name That Scenario

This site gives you a chance to practice recognizing the appropriate situations in which to apply various statistical procedures. You will be presented with a series of ten real-world statistics scenarios. Your task is to select the most appropriate statistical procedure for each scenario.

**DIRECTIONS**

1. Select at least two of the following Procedures.

2. Choose "First Scenario" to begin.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Proportion</td>
<td>ANOVA</td>
</tr>
<tr>
<td>Two Proportions</td>
<td>Regression</td>
</tr>
<tr>
<td>One Mean</td>
<td>Chi-sq Goodness of Fit</td>
</tr>
<tr>
<td>Paired</td>
<td>Chi-sq Homogeneity</td>
</tr>
<tr>
<td>Independent T-test</td>
<td>Chi-sq Independence</td>
</tr>
<tr>
<td>First Scenario</td>
<td></td>
</tr>
<tr>
<td>Clear selection</td>
<td></td>
</tr>
</tbody>
</table>
Example Outcome

Authored LOs (Physical Chemistry)

- Time-Dependent Superposition of Rigid Rotor Eigenstates
- Rotational-Vibrational Spectrum of a Diatomic Molecule
- Temperature-Dependent Rotational Energy Spectrum
- Hydrogen Atom Radial Functions
- Time Evolution of a Quantum Free Particle in 2D
- Perturbation Theory Applied to the Quantum Harmonic Oscillator
- Time-Dependent Superposition of 2D Particle-in-a-Box Eigenstates
- Time Evolution of a Quantum Free Particle in 1D

demonstrations.wolfram.com/author.html?author=Porscha+McRobbie
This Demonstration studies the pure rotational spectrum of the quantum rigid rotor problem (neglecting centrifugal distortion), described by the Hamiltonian $\hat{H} = \frac{\hat{j}^2}{2I}$, where $\hat{j}$ is the angular momentum operator and $I$ is the moment of inertia. The energy levels are given by $E_n = n(n + 1)\hbar^2 / 2I$, where $\hbar = \frac{h}{2\pi}$ is the rotational constant and the transition matrix $\Delta E = 16\hbar I$. The $J$ values range from 0 to 9.
• Demonstrates the Frustration-Aggression Hypothesis

• Adena Rottenstein (graduate student) authored with an undergraduate student

• Winner of the Cengage Psychology ‘Get Psyched’ Video Contest

Hosted at:  http://youtu.be/oe8PJ8rVV0M
Initial Perceived Barriers Alter!

to using technology in teaching or learning

- Many useful online learning resources exist, but most must be adapted to become a useful match to a given course/curricula!
Example Barrier

Imperfect LO!

- Simulating Confidence Intervals
- Authors: Beth Chance, Allan Rossman (CP)

http://www.rossmanchance.com/applets/Confsim/Confsim.html
Disadvantages of LO?

• Learning Objectives?
• Directions?
• Terminology/Notation unknown to our students

Advantages of LO?

• Addresses fundamental concept.
• Provides excellent visual demonstration.
• User can adjust controls.
Initial Perceived Barriers Alter to using technology in teaching or learning

and calm down.

of a plan.

wisely.

MERLOT International Conference 2008
The Outcome
LO Video Capture

Video Capture the LO to:
• Introduce the LO and/or
• State or clarify learning objectives and/or
• Explain inconsistency in notation, and/or
• Shows how it works
Instead of:

LO
Students will see:

- Objectives
- Directions
- Assessment
- LO
Lesson 03:

In this lesson, you will generate confidence intervals for estimating a population proportion. You will be able to set the value of the (usually unknown) population proportion, the sample size, and the confidence level. You also are able to decide how many samples will be generated and a confidence interval based on each sample will be computed and displayed. The applet graphs the intervals and those which did contain the true proportion are shown in green, while the intervals that did not contain the true proportion are in red. The true proportion is shown by a blue line on the graph. Trying different settings will allow you to make comparisons and draw some important conclusions about how confidence intervals work.

Simulation Link:

The simulation may be found here.

Assignment:

Check Ctools for due date and submission details.

For each of the questions below, use the applet to help you address the question. Submit your 1-2 sentence summary for each question directly inline to your GSI Ctools site Assignment for prelab3 (or as instructed on your class Ctools site).

1 - Set the confidence level to 99% and the sample size to 100. (a) What is the long run proportion of confidence intervals that contain the population proportion? (b) Does this long run proportion depend on the sample size \( n \)? (Try some other sample sizes keeping the confidence level at 99%)

2 - What happens to the length of the confidence intervals as the confidence level increases? Compare some intervals at the 90%, the 95%, the 99% confidence levels (keeping the population proportion and the sample size \( n \) the same).

3 - What happens to the length of the confidence intervals as the sample size increases? Compare some intervals made using sample sizes of \( n = 30 \), \( n = 50 \), and \( n = 100 \) (keeping the population proportion and the confidence level the same).
Collect Quality Learning Objects
Perceived Barriers Alter!
to using technology in teaching or learning

STOP
and calm down.

THINK
of a plan.

PROBLEM
SOLVE
wisely.

Many useful online learning objects exist \textbf{but} ...

Which LOs may be freely adapted for course infusion - i.e. which are OER?
Graduate Student Instructors

- Interest in tech + pedagogy
- Train to find, evaluate, package, author online LOs

Project Faculty Mentors

- Coordinators/instructors of large gateway courses.
- Guidance on best practices to enhance teaching/learning

Other Faculty

- Provide schedule of topics and concepts
- Provide insight on muddy points and desirable LOs

Add Staff

- Provide basic grant support
- Some technology support
- OER support
Initial Cross-Disciplinary Pollination

Statistics

Show and Tell
How do I look up properties of compounds in the **CRC Handbook**?
Example Tool Pollination

Personalized Video Feedback (Writing)

- Video captured feedback
  - personalized feedback on student papers.

- Screen captured tutorials
  - e.g., how to construct a concept map for writing

http://www.screencast.com/users/cmodey/folders/Jing/media/8bd96754-d693-4b5e-ba59-952afb2f2e4d
Example Tool Pollination

Grammar Videos/Podcasts (Spanish)

- What is the difference between imperfect and preterit?
- What is...?
What is the difference between imperfect and preterit?

This site contains podcasts with grammar explanations for Spanish 103 Intensive Review. Enjoy!

Unidad 1

Unidad 2

Unidad 3

Unidad 4

Grammar Podcasts for Spanish 103
4108 Modern Languages Building | 812 East Washington Street | Ann Arbor, Michigan 48109-1275 | USA | Fax: (734) 764-8163
Contact: tcalixto@umich.edu
2011 - 2012

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You may remix, tweak, and build upon non-commercially, as long as you attribute it to the author(s) cited and license your new creations under identical terms.
Perceived Barriers Alter!
to using technology in teaching or learning

- Quality online learning objects exist, but some do not use an appropriate or best pedagogical approach/technology tool to enhance learning and teaching.
Move from a model where students are not only learners but also co-teachers

Cross-Disciplinary Outcome
Social Media Tech
Students as co-teachers
Example Outcome

Online LO Pre-Labs with VoiceThread (Org chem)
Example Outcome

Facebook as a Discussion Board (Psychology)

Students use Facebook in a variety of ways for discussion:

- Post links to videos, news articles
- Comment on each others posts

Adena Rottenstein
Example Outcome

Reflective Writing Video Collection (Writing)

Melo3D Revision Mock-Up Site

Home >

What's the Big Takeaway?

OBJECTIVES:

- students will take away that revision is time-consuming but worth it
- students will take away that they should approach others, get another perspective
- being self-critical, self-aware, able to adopt an outsider perspective

These students discuss the most important lessons they have learned about experiences.

Meaghan: "I Spend a lot of Time Doing Revision"
Welcome to our site, "Exploring Revision." We have designed this site to help you think about your own revision process, consider new ways to approach and think about revision, and to ease your fears about revision. Revision is often the most frustrating part of the writing process, and we hope that listening to students like yourself talk about how they approach and think about revision, you will find new ways to make the revision process productive and rewarding.

Click on the links below to view videos and answer questions on the following topics:

Alternative text:

*Great pieces of college writing are made in the process of revision.*

One true thing about revision is this: it's an awful lot of work. In fact, it's so much work that many writers, especially new writers, often avoid it.

Revision requires the ability to look at your own work objectively, to assess its strengths and weaknesses, to shrewdly identify where the piece has gone wrong and what you must do to fix it, to consider and incorporate the feedback of others without allowing it to overwhelm your own sense of purpose.

Above all, effective revision requires taking ownership of your writing and rewriting it, not so much to fit a rubric or to please a teacher but to fulfill your own vision for the essay.

This series of videos will help you to see the process of revision in all of its challenge, excitement, frustration, and satisfaction through the eyes of undergraduates at the University of Michigan. These clips address some of the most frequently asked questions about the revision process, including:

- How do I make a revision plan?
- How can I best manage my time in the revision process?
- How do I incorporate feedback from others?
- How do I deal with frustration in the revision process?
New Outcomes (Gen Chem)

Shift of lecture class format

Transforming A Large Lecture To An Interactive Personalized Online Format
Transforming Lecture

Stepping Stones to the Multimedia Online Format

- Online Learning Resources
- Video Capture of demonstrations
- Podcasts
- Software

http://www.umich.edu/~chem125/softchalk/Exp2_Final
Preparing a solution of known concentration

What is a mole?

The first thing you will need to understand when making a solution is the concept of a mole. A mole is a number $6.02 \times 10^{23}$ to be exact. All chemistry calculations are calculated in moles. The concept of a mole is just like the concept of a dozen. There are 12 objects in a dozen, just like there are $6.02 \times 10^{23}$ objects in a mole. When working with different elements, they all have different atomic weights.

The atomic weight is how many grams of that element will make up one mole (or $6.02 \times 10^{23}$ atoms). When this is applied to a ionic or molecular compound, the molecular or formula weight of the compound is determined by combining the atomic weight of all the atoms in the compound. The atomic weights for each atom can be found on any periodic table.
New Outcomes

Shift lecture class format

History of the American West: History 373

• Transition from lecture to interactive meetings
• Interactive syllabus
• Technology tools for “real – time historical inquiries
• Move from content-based pedagogy to integrating transferable skills such as analysis of primary resources

https://amwest.pbworks.com/w/page/43768438/Syllabus
Week One: The First American West

September 6: Course Introduction

No required reading for today.

September 8: The Ohio Territory and Indian Country

Readings
* Andrew Cayton, "Noble Actors Upon the Theatre of Honour: Power and Civility in the Treaty of Greenville" (Ctools)
* Treaty of Greenville (1795)
* Declaration of Independence
* Letter to Governor William H. Harrison, February 27, 1803

From The Philadelphia Aurora (A Philadelphia Newspaper):
* “The Savage Tomahawk,” November 24, 1812 (reprinted in The Columbian)
* “The War,” September 19, 1812 (reprinted in The American Mercury)
* David Thompson, History of the Late War Between Great Britain and the United States (1832)

Note: to scroll to the bottom of the newspaper articles, click and scroll at the same time.

Study Questions

a. Describe the civilizing mission of the United States and explain how this concept related to Thomas Jefferson's Indian Policy.

b. How did Americans in the early 19th century understand their relationship to Native peoples? Was there a place in the republic for Indian peoples? Base your answers on public policy and popular discourse in the early republic.
Overall “IDEAS” Outcome

Move from a model where students are not only engaged learners but also co-teachers

Technology Integration via cross-disciplinary pollination is a successful model
Current Goals

**Shift in focus** from technology development and integration of online learning objects to:

- Assessment of technology infusion impact on learning
- Web accessibility concerns

Go to the MELO presentation:

“Online learning Objects: Affecting Change through Cross-Disciplinary Practices and Open Technologies”
Emily Puckett Rodgers, Steve Lonn and others
Thursday July 26, 10:10 am, Marco Polo 706-707
Additional Source Information


http://www.flickr.com/photos/horiavarlan/4268896468/


Slide 36: Image courtesy of lumaxart, ”Working Together Teamwork Puzzle Concept,”
http://www.flickr.com/photos/lumaxart/2137737248/


Slide 49: Image courtesy of University of Michigan MSIS, ”Class-Lecture-Hall-Abrams-2,”
http://www.flickr.com/photos/umich-msis/6650333283/in/photostream/

Slide 50: Image courtesy of Rob Pearce, "Laptop and working lunch. An outside table with a silver laptop, coffee and a sandwich on it”
http://www.flickr.com/photos/54268887@N00/5056901103/in/photostream/

Slide 50: Image courtesy of derrickkwa, "podcast_subscribe,”
http://www.flickr.com/photos/15319336@N07/2060971197/in/photostream/

Slide 54: Image courtesy of Moyann Brenn, “thank you note for every language”
http://www.flickr.com/photos/aigle_dore/5849712695/in/photostream/