Chemistry Impact Grant Project Plan

5/30/2013
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Executive Summary
Computer simulations and inquiry-focused tasks will be used in a technology-rich classroom in an effort to dramatically alter the traditional lecture format of an introductory chemistry course. The course (Chem 161), which enrolls students majoring in Chemistry, will be re-designed to include these small group activities on a weekly basis. Evaluation and dissemination of course changes will be a high priority.

Problem / Opportunity
Introductory Chemistry courses at OSU are almost exclusively taught in a traditional lecture format, with a lab component and (perhaps) a recitation (taught by a teaching assistant). The lack of student-led inquiry tasks in these courses leads to an absence of in-class problem solving and does not promote critical thinking within the class period. Using in-class computer simulations that are robust and open-ended, when coupled with inquiry-focused tasks and the use in-class group assignments, have the potential to dramatically alter the traditional course framework. In such a course, students will experience traditional lectures, but will also have the opportunity to manipulate “experiments” in class, observe phenomena, and collect, analyze, and discuss data with classmates.

Project Goal(s)
• Increase the number of in-class authentic inquiry tasks, especially ones employing computer simulations, within a technology-rich version of Chemistry 161.
• Increase additional learning opportunities (practice modules) outside of class using computer simulations (to promote anytime/anyplace learning).
• Assess project program, focusing on concept retention and student engagement.
• Impact course instruction dynamics where verbal instruction and enhancement of concepts occur in class and student work is accomplished outside of class.
Project Objectives

- Identify current lecture format course topics that may benefit from student use of simulations.
  - Identification may occur in a combination of true deficiencies identified from past courses, as well as dictated by the availability of premade learning modules.
- Discuss and establish an evaluation scheme for Chem 161.
  - Classroom technology capabilities will be considered.
- Apply evaluation criteria and assess multiple (published) simulations for inclusion in Chem 161.
  - Focus is on in-class work.
- Evaluate supporting material and documentation.
  - Components include logistics, pedagogical affordances, connection to other course activities, time to work through, and so on.
- Explore logistical and pedagogical options for integrating lectures and simulations. Investigate strengths and weaknesses of different options; test with students.
- Gain iRB approval.
- Re-design course framework to include simulations.
- Implement and establish simulations.

In-Scope

- Integration of computer simulations in Chemistry 161 course, Fall 2010.
- Evaluation of the course changes.

Out-of-Scope

- Development (e.g., programming) of assets.
- Changing the lab component instructional method.

Success Criteria

- Topics for simulation-based learning activities identified.
- Evaluation scheme for Chem 161 established.
- Assessment criteria for potential simulations established.
- Evaluated material and support documentation of simulation option.
- Explored logistical and pedagogical options for integrating lectures and simulations.
- IRB approval obtained.
- Course framework redesigned to include simulations.
- Implemented and established simulations, during Fall 2010 for Chem 161.
  - Implemented into two lecture sections taught in 311 Central Classrooms.
- Simulations used and evaluated in Fall 2010.
- Participants remained within time and budgetary constraints of Impact Grant and Departmental resources provided for the project.
- Document produced describing student learning outcomes.
- Transition from LT personnel and financial support does not disrupt Chem 161 teaching and learning.

Project Assumptions

- Students will honestly assess their in-class experiences and concept retention.
- Students will be open to non-traditional instruction.
- Chemistry faculty/staff will remain involved in this project.
### Projects Risks

<table>
<thead>
<tr>
<th>Risk Description</th>
<th>How Likely</th>
<th>Impact</th>
<th>Score likely x impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to schedule classroom</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Schedule ASAP (DONE) 9:30/12:30 lectures</td>
</tr>
<tr>
<td>Unable to find suitable simulations</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>Consider alternative inquiry tasks (DONE) Found potential simulations</td>
</tr>
<tr>
<td>Failure to gain IRB approval for evaluation</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>Proceed with internal evaluation</td>
</tr>
<tr>
<td>Student cheating with increased online components</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Willingness to test different approaches</td>
</tr>
<tr>
<td>Unable to form a consensus regarding inquiry-focused classroom pedagogy</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>Frequent discussions already underway</td>
</tr>
<tr>
<td>Instructor, student expectation difference</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Flexibility when implementing week-to-week simulations. Willingness to provide extra supporting material and/or traditional lectures.</td>
</tr>
<tr>
<td>Challenges integrating in-class feedback to the instructor.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Test feedback mechanism in advance in as authentic of circumstance as possible.</td>
</tr>
<tr>
<td>Moving through content to ensure concepts covered prior to moving to the next course in the series</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Willingness to provide extra supporting material and/or traditional lectures as needed.</td>
</tr>
<tr>
<td>Number of people involved in the project.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Continual awareness as to which aspects of this technology-rich offering can be transferred to larger general chemistry courses.</td>
</tr>
<tr>
<td>TAs, extroverted individuals not identified</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Ted, Rosemary to help dynamically provide feedback</td>
</tr>
</tbody>
</table>

### Obstacles / Constraints

- Students and faculty do not like the technology that was selected.
- Students resisting increased out-of-class work expectations in order to successfully utilize in-class simulations and activities (resisting increased accountability).
Schedule Considerations / Other Projects / Related Projects

**Chemistry**
- Revision of accompanying laboratory component

**LT**
- Other Impact Grants (EEOB and Math)
- Spring Symposium planning (Innovate! in May)
- Bridge: A virtual online community around eLearning

Project Milestones and Major Deliverables

<table>
<thead>
<tr>
<th>Milestone/Deliverable</th>
<th>Target Week</th>
<th>Responsible</th>
<th>M/D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topics for simulation-based learning activities identified.</td>
<td>April 1</td>
<td>Loza, Clark</td>
<td>M</td>
</tr>
<tr>
<td>Identification of supporting content, preparation of in-class material, simulations</td>
<td>April 1</td>
<td>Clark, Loza, Spinney, Mamais</td>
<td>D</td>
</tr>
<tr>
<td>Technology &quot;testing&quot; and evaluation</td>
<td>May 1</td>
<td>Spinney, technology staff</td>
<td>D</td>
</tr>
<tr>
<td>Design of supporting technology. In-class, out-of-class interface</td>
<td>May 1</td>
<td>Spinney, Clark, Loza, technology staff</td>
<td>M</td>
</tr>
<tr>
<td>Evaluation proposal (pre and post)</td>
<td>July 1</td>
<td>Clark, Irving, Loza</td>
<td>D</td>
</tr>
<tr>
<td>IRB</td>
<td>July 30</td>
<td>Clark</td>
<td>D</td>
</tr>
<tr>
<td>Class Redesign finished</td>
<td>August 1</td>
<td>Loza, Spinney, Clark</td>
<td>D</td>
</tr>
<tr>
<td>Class implementation and assessment</td>
<td>Fall 2010</td>
<td>Persons</td>
<td>D</td>
</tr>
<tr>
<td>Document outcomes</td>
<td>Dec. 27</td>
<td>Clark, Irving, Rob Griffiths</td>
<td>D</td>
</tr>
<tr>
<td>Transition from LT personnel and financial support to self supporting model</td>
<td>Dec. 27</td>
<td>Rob Griffiths, Clark</td>
<td>M</td>
</tr>
</tbody>
</table>

Project Resource Summary

**Release Time:**
- Rosemary Bartoszek-Loza                  LT = 0       Dept = $8,500
- Supplement Compensation                   LT = $2,500  Dept = $2,500
- Consultant: Jessica Mamais                LT = $2,500  Dept = $0
- Conference Expenses                       LT = $2,000  Dept = $0
- Student support                          LT = $3,000  Dept = $0
- Assessment: Educational consultants       LT = $5,000  Dept = $2,500
- Assessment Consultant: Karen Irving      LT = $0      Dept = $2,500

LT total: $15,000  Chemistry total: $16,000