Lessons Learned By Designing and Instructing An Undergraduate Chemistry Course

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Acknowledgement

Chem 179 – Nanomaterials for Energy Storage Devices (Spring 2015)

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Outline

- Overview of the Course Design (~5 min)
- Lessons Learned (~5 min)
Course Design
Class Overview

Class size

- 8 students (junior and senior undergraduates)
Class Overview

- **Class size**
  - 8 students (junior and senior undergraduates)

- **Lectures**
  - One lecture per week
  - Before each week’s lab sections

- **Lab Sections**
  - 2 groups: 4 students per group
  - One lab section per week
Class Overview

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Lab Sections
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- One lab section per week

eCommons: Grades/Slides/Papers/Announcements etc.
Class Schedule

- **Week #3**
  - Lab #1: Carbon Materials
  - Lab Report #1
  - Midterm Presentation

- **Week #5**
  - Lab #2: Manganese dioxide
  - Lab Report #2

- **Week #9**
  - Lab #3: Student designed experiments
  - Lab Report #3
  - Final Presentation

- Two lab sections designed by me
- Student design

Final Exam
Lab Reports (65% total)

- Scientific writing style
- Three lab reports in total (two regular + one final)
Course Evaluation

Lab Reports (65% total)

- Scientific writing style
- Three lab reports in total (two regular + one final)

Title + Author Info

Part 1

Background/Introduction

Part 2

Summary of experimental methods and mechanism

Part 3

Data

Part 4

Analysis and Discussion (address questions)

Conclusion
Course Evaluation

Presentations (20% total)

Peer-review
Course Evaluation

Presentations (20% total)

Peer-review

9.5/10

8.5/10

7.5/10

9/10

8/10

0/10
Course Evaluation

Presentations (20% total)

- Peer-review

9.5/10
8.5/10
9/10
7.5/10
8/10
0/10

Average Score
8.3/10
Course Evaluation

Presentations (20% total)

- Peer-review
  - Course Instructor (me)
  - Invited Graduate Students (“Experts” and “Non-experts”)
  - Course Advisor
  - Fellow Students

(Equal Weight)
## Presentations (20% total)

### Evaluation Criteria

**For the instructor and students**

<table>
<thead>
<tr>
<th>Background</th>
<th>Clearly introduced supercapacitors? ___/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>Clearly state the motivation of their work? What is/are the goal(s) of their work? ____/5</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Clearly present a synthesis route? (e.g. flow chart) ___/2</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>SEM data and analysis ___/2</td>
</tr>
<tr>
<td></td>
<td>CV data and analysis ___/4</td>
</tr>
<tr>
<td></td>
<td>CP data and analysis ___/4</td>
</tr>
<tr>
<td></td>
<td>EIS data and analysis ___/2</td>
</tr>
<tr>
<td>Summary</td>
<td>Use of any papers to support their arguments? ___/2</td>
</tr>
<tr>
<td></td>
<td>A clear summary/conclusion? ___/1</td>
</tr>
<tr>
<td></td>
<td>Proposed some reasonable future work(s) that can enhance the performance? ___/1</td>
</tr>
</tbody>
</table>

**Total Score:** _____/25
Course Evaluation

Presentations (20% total)

Evaluation Criteria

For the invited non-experts

1. Do you understand most of their presentation?
2. Did they provide a clear background about supercapacitors?
3. Did they present a clear and solid motivation/goal for their work?
4. Did they clearly analyze their data with some scientific papers cited to support their arguments?
5. Do you think they were confident when answering questions and they successfully addressed most of the questions asked by others?
6. In all, do you think their presentation is well-organized?
Course Evaluation

Lab Effectiveness (5%)
- Active participation?
- Safety?

Take-home Final Exam (10%)
- Comprehensive understanding
- Based on recently-published papers (challenging but approachable)
- Instructor available for answering questions
Lesson Learned
(based on students’ feedback)
Battery-type materials were only briefly touched upon and I would have liked to learn a bit more. Also, the grading method for the presentations can be improved as fellow classmates can conspire to give other groups poor grades. The instructor's grade should greatly outweigh the grades given by other classmates.
Feedback #1

- Battery-type materials were only briefly touched upon and I would have liked to learn a bit more. Also the grading method for the presentations can be improved as fellow classmates can conspire to give other groups poor grades. The instructor's grade should greatly outweigh the grades given by other classmates.

Lesson #1

Assign different weights based on the identity of the peer-reviewers.
It would have been great if the expectations or guidelines to projects/presentations/labs/etc had been posted in a timely fashion and explicitly; in particular, I am referring to the beginning of the course.
Post guidelines at the beginning of the class to make my expectation more clear (esp. the final exam).
The questions on the lab reports were often very difficult. Basically we had to read many papers not assigned until we found an answer that was only tangentially connected to what the question was asking and used that. Often we answered with guesses instead of actually knowing.
Feedback #3

The questions on the lab reports were often very difficult. Basically we had to read many papers not assigned until we found an answer that was only tangentially connected to what the question was asking and used that. Often we answered with guesses instead of actually knowing.

Lesson #3

• Over-expected students’ self-motivation;
• Re-design questions (e.g., explicitly write papers needed)
- Tianyu did an excellent job both lecturing and in the lab. The SEM demo was my favorite part and it really helped excite me about future research in the field and being able to use...
Tianyu did an excellent job both lecturing and demonstrating the SEM. The SEM demo was my favorite part and it really opened my mind about future research in the field and beyond.
Lesson #4

- SEM (Scanning Electron Microscopy)
- Expose students to some advanced instruments for motivation.

Tianyu did an excellent job both lecturing and showing the SEM demo was my favorite part and it really opened my eyes about future research in the field and beyond.
11. Instructor’s overall effectiveness as a teacher 4.8/5.0

17. The course overall as a learning experience 4.8/5.0
• Course Website

http://liutianyuresearch.weebly.com/nanomaterials-for-energy-storage-devices.html

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