Biology 692P / Chemistry 692P / Geosciences 692P
Special Topics in Scientific Teaching
Spring 2012

This syllabus and schedule are subject to change. Any changes will be announced in class.

Instructors:

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<td>Office hours:</td>
<td>By appointment</td>
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<tr>
<th>Sarah Fowell</th>
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<td>Office hours:</td>
<td>By appointment</td>
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Credits: 2
Meeting Time and Location: 308 Bunnell, Monday, 6:00-8:00 pm

Course Materials:


• See the syllabus for additional reading assignments and citations.

• You will be expected to prepare and share materials for courses that you teach, particularly any course that you are currently working with.

Course Description:
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment and course management that have been shown by research to improve student learning. This course is intended for graduate students in the sciences who have an interest in improving their teaching skills. This course will become a component of an instructor training program that is currently under development. The course format will be a mixture of discussions, workshops and seminars. If the course is over-enrolled, priority will be given to teaching assistants who are assigned to teach large, introductory level (100 or 200 level) courses during the semester they are taking this course.

Course Purpose:
Our goal is to prepare you to design your own quality undergraduate science courses and strengthen your professional resume. Quality instruction of undergraduate courses is essential to the development of skilled, highly-knowledgeable undergraduates. Good instructional skills, although they take time and effort to acquire, ultimately make an instructor a better and more efficient teacher. This course aims to develop instructional skills of graduate students who are currently teaching undergraduate-level courses and/or labs, and prepare them for careers that may have a strong teaching component to them. This includes not only tenure-track professorial positions, but any positions which require the ability to explain and teach things to others.

By the end of the semester, you will be able to:

1. Design a teachable unit. This is an integrated, 2-3 week block of topics, activities, laboratory exercises and assessments, constructed around clearly stated learning goals (things students should know or be able to do upon completion of the unit). Teachable units are the building blocks of a well-designed undergraduate or graduate science course!

2. Present a 10-minute activity that employs active learning strategies and frame it in the context of your teachable unit.
3. Construct and maintain a learner-centered classroom.

4. Draft a teaching philosophy that reflects understanding of current educational research and how students learn. Such philosophies are a standard part of a college or university faculty application. A philosophy that incorporates active learning strategies, student-centered outcomes and a variety of assessment tools is crucial for positions that involve aspects of teaching and curriculum design.

Course Goals
- to help students and instructors improve their ability to teach both course content and the analytical skills undergraduates need to carry out inquiry-based science
- to familiarize students with the best teaching practices, as established by research
- to provide students with the skills and support to implement active learning in their classrooms
- to provide students with the opportunity to experiment with new instructional and assessment techniques and discuss how well they worked
- to encourage students to reflect on instructional techniques they use and how well suited they are to the students in a particular class
- to familiarize students with resources available to support these goals

Specific Student Learning Outcomes
- apply backwards design to develop a teachable unit
- use active and inquiry-based learning in the classroom and the lab
- employ a variety of different teaching techniques to reach a diverse group of students and explain to students why they should take advantage of multiple approaches to learning
- effectively design and use both formative and summative assessments
- integrate a variety of assessment formats into courses
- clearly communicate course and assessment expectations and standards to students
- develop a classroom management strategy to enhance student learning
- use various tools to assess your own efficacy as an instructor and make adjustments

Grading: Teachable units, presentations, participation, reading assessments and teaching philosophies will be graded according to the following scale: 100-90% = A, 89% = A-, 88% = B+, 87-80% = B, 79% = B-, 78% = C+, 77-70% = C, 69% = C-, 68% = D+, 67-60% = D, 59% = D-, <59% = F.

Grading Scheme:

<table>
<thead>
<tr>
<th>Item</th>
<th>Portion of Final Grade</th>
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<tr>
<td>active participation in and preparation for weekly discussions</td>
<td>20%</td>
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<tr>
<td>performance on weekly reading assessments</td>
<td>20%</td>
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<tr>
<td>presentation to group of a learning activity prepared as part of your teachable unit – focused on a particular objective of the unit, approximately 10 minutes in length *</td>
<td>20%</td>
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<tr>
<td>preparation of a teachable unit that includes active learning strategies, lab activities, and both formative and summative assessments with an explanation of how each of these will further the stated goals and objectives*</td>
<td>20%</td>
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<tr>
<td>a written, formal statement of personal teaching philosophy*</td>
<td>20%</td>
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*If this item is of substandard quality, additional revision and resubmission may be required.
# Schedule for Spring 2012, BIOL/CHEM/GEOS/PHYS 693P: Special Topics in Scientific Teaching (subject to change)

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<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Due at start of class</th>
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<tbody>
<tr>
<td>Jan. 23</td>
<td>How People Learn; What Active Learning Is and Isn’t</td>
<td>- Armbruster et al. 2009&lt;br&gt;- Knight &amp; Wood 2005</td>
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<td>Jan. 30</td>
<td>Bloom’s Taxonomy – How to help students develop analytical skills and think “like a scientist”; designing formative and summative assessments to develop and evaluate these skills; when and how to grade; rubrics</td>
<td>- Handelsman et al., Ch 1 &amp; 3&lt;br&gt;- Harris 2002&lt;br&gt;- Kruger and Dunning 1999&lt;br&gt;- Bring an exam from an undergraduate course to examine</td>
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<td>Feb. 6</td>
<td>Backward Design – using goals and objectives to drive course design; Goals and Objectives – writing useful ones; How to use concept inventories</td>
<td>- Stokes et al. 2007&lt;br&gt;- D’Avanzo 2008&lt;br&gt;- Libarkin &amp; Anderson 2005</td>
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<td>Feb. 13</td>
<td>Teaching in the Laboratory Setting – types of labs; Peer review of goals and objectives</td>
<td>- Casotti et al. 2008&lt;br&gt;- Apedoe et al. 2006&lt;br&gt;- Bring a lab that you’ve done (not the supplies, but the written exercise)&lt;br&gt;- Goals and objectives for a teachable unit</td>
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<td>Feb. 20</td>
<td>Teachable Unit – What is a teachable unit and how can an instructor develop a really good one? Examples and rubric Debunking learning styles</td>
<td>- Handelsman et al., Ch 5&lt;br&gt;- Gautier et al. 2006&lt;br&gt;- Pashler et al. 2009</td>
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<td>Feb. 27</td>
<td>Active Learning I – active learning as a formative assessment tool; audience response systems (clickers), think-pair-share, case studies, and how to use them Work on rubric for grading class presentations; Examples of submitted activities</td>
<td>- Handelsman et al., Ch. 2&lt;br&gt;- Greer &amp; Heaney 2004&lt;br&gt;- Karpicke &amp; Blunt 2011&lt;br&gt;- Lesson plan for a teachable unit with revised goals and objectives</td>
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<td>Mar. 5</td>
<td>Active Learning II – other techniques to engage students: minute papers, strip sequences, concept maps and concept diagrams</td>
<td>- Englebrecht et al. 2005&lt;br&gt;- McConnell et al. 2003&lt;br&gt;- Description of an activity for your teachable unit, with goals, objectives, and assessment method</td>
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<td>Mar. 12</td>
<td>Spring Break</td>
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<td>Mar. 19</td>
<td>Active Learning III – engagement continued: kinesthetic activities and modeling processes <em>Sample teaching philosophies and teaching philosophy rubric; 5-paragraph essay format and paper organization; structure of sample philosophies</em></td>
<td>- Haak et al. 2011&lt;br&gt;- Moravec et al. 2010</td>
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<tr>
<td>Date</td>
<td>Activity</td>
<td>Resources</td>
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| Mar. 26| Writing a Teaching Philosophy – what a teaching philosophy is and how to write a great one | • O’Neal et al. 2007  
• sample teaching philosophies  
• Map organization of 2 writing samples  
• **Revised teachable unit + activity** |
| Apr. 2 | Group Work I – Brainstorming, jigsaw exercises; jigsaw assignment          | • McConnell et al. 2005  
• Shimazoe & Aldrich 2010  
• Felder & Brent 2001  
• **Draft of teaching philosophy** |
| Apr. 9 | Group Work II – Jigsaw wrap-up, peer instruction and collaborative thinking | • Crouch & Mazur 2001  
• Yuretich et al. 2001  
• **Your piece of the jigsaw**  
• **Revised teaching philosophy** |
| Apr. 16| Inquiry-Based Learning – the difference between investigative labs, guided inquiry and open inquiry learning | • Justice et al., 2007  
• **Final teachable unit** |
| Apr. 23| Student Presentations of Teachable Unit, Outcomes, and One Complete Activity| • **teachable unit presentation**  
• **Final teaching philosophy** |
| Apr. 30| Student Presentations (continued)                                         | • **teachable unit presentation** |

**Full citations for articles:**


Additional readings (not required, strictly for your own interest):


