STO 666 - Special Topics in Scientific Teaching
Spring 2015

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

Instructors:

<table>
<thead>
<tr>
<th>Denise Kind</th>
<th>PhD, Biology and Wildlife</th>
<th>Sarah Fowell</th>
<th>PhD, Geology and Geophysics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email: <a href="mailto:dmkind@alaska.edu">dmkind@alaska.edu</a></td>
<td></td>
<td>Email: <a href="mailto:sjfowell@alaska.edu">sjfowell@alaska.edu</a></td>
<td></td>
</tr>
<tr>
<td>Office: 223C Murie</td>
<td></td>
<td>Office: 326 REIC</td>
<td></td>
</tr>
<tr>
<td>Office phone: 474-6298</td>
<td></td>
<td>Office phone: 474-7810</td>
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<tr>
<td>Office hours: By appointment</td>
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Credits: 2
Meeting Time and Location: 302 Murie, 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 day block of activities and assessments, constructed around clearly stated learning goals and objectives (things students should know or be able to do upon completion of the unit) and common misconceptions. Teachable units are the building blocks of a well-designed undergraduate or graduate science course!

2. Present three 5-10-minute activities that employ **active learning strategies** and are based on common misconceptions.
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
- improve your ability to teach both course content and the analytical skills undergraduates need to engage in the study and practice of science
- become familiar with the best teaching practices, as established by research
- develop the skills and support to implement active learning in their classrooms
- experiment with new instructional and assessment techniques and discuss how well they worked
- reflect on instructional techniques and practices
- identify available resources to support curriculum design goals

Specific Student Learning Outcomes
- apply backwards design to develop a teachable unit
- use active learning in the classroom
- 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 formative assessments driven by common misconceptions
- 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>10%</td>
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<tr>
<td>performance on weekly reading assessments</td>
<td>10%</td>
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<td>feedback and reflections</td>
<td>10%</td>
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<td>presentation to group of 3 learning activities prepared as part of</td>
<td>30%</td>
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<td>your teachable unit – focused on a particular objective and</td>
<td></td>
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<td>misconception, approximately 5-10 minutes in length</td>
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<tr>
<td>preparation of a teachable unit that includes goal &amp; objectives,</td>
<td>20%</td>
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<tr>
<td>active learning strategies, and formative and assessments with</td>
<td></td>
</tr>
<tr>
<td>an explanation of how the activities further the stated goals and</td>
<td></td>
</tr>
<tr>
<td>objectives*</td>
<td></td>
</tr>
<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 STO 666, Scientific Teaching:
## Spring 2015 (subject to change)

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<tr>
<th>Date</th>
<th>Topic</th>
<th>Due at start of class</th>
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| Jan. 26 | How People Learn; What Active Learning Is and Isn’t                   | • Freeman et al. 2014  
• Wood 2009                                                                         |
| Feb. 2  | Backward Design – goals and objectives to drive course design; using misconceptions and threshold concepts | • Wiggins & McTighe, Ch.1,2,5  
• Understandings and Essential Questions for a week-long unit in a 100-level course (W&M, Template) |
|         | Goals and Objectives – writing useful ones                           |                                                                                       |
|         | Teachable Units - Structure and format                               |                                                                                       |
| Feb. 9  | Prior Knowledge and Misconceptions – How these impact course structure and student learning | • Kruger and Dunning 1999  
• Wiggins & McTighe, Ch.4,6  
• Goals & objectives for your teachable unit |
|         | Bloom’s Taxonomy and the Six Facets of Understanding                |                                                                                       |
| Feb. 16 | Active Learning I – active learning as a formative assessment tool; audience response systems (clickers), think-pair-share | • Rushton, 2005  
• Crouch & Mazur, 2001  
• Misconceptions related to essential questions  
• Peer review of 2 sets of goals and objectives |
|         | Discuss Peer Review of goals and objectives                         |                                                                                       |
| Feb. 23 | Students present 5-10 minute series of 3-4 different clicker questions and receive feedback | • Wiggins & McTighe Ch 7  
• 3-4 Clicker questions  
• Revised goals/objectives |
| Mar. 2  | Active Learning II – case studies                                    | • Wiggins & McTighe Ch 9  
• Reflection on how to revise or modify your clicker questions  
• Draft of Evidence and Instruction for your teachable unit (W&M) |
| Mar. 9  | Students present 10-15 minute case study                             | • Original case study + goals/objectives                                               |
| Mar. 16 | **Spring Break**                                                     |                                                                                       |
| Mar. 23 | Active Learning III –kinesthetic activities and modeling processes    | • Wiggins & McTighe Ch 10,11  
• Reflection on how to revise or modify your case study                                |
| Mar. 30 | Student present ~10 minute kinesthetic or modeling activity          | • Kinesthetic or modeling activity + driving misconception  
• Revised Evidence and Instruction for your teachable unit (W&M) }
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<th>Readings</th>
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| Apr. 6   | Active Learning IV - other techniques to engage students: minute papers, strip sequences, concept maps and concept diagrams | • Englebrecht et al. 2005  
• Handelsman et al. Ch 3  
• Reflection on how to revise or modify your kinesthetic or modeling activity |
| Apr. 13  | Classroom Structure: Group work, brainstorming, jigsaw exercises, peer instruction, collaborative thinking | • Shimazoe & Aldrich 2010                                                   |
| Apr. 20  | Writing a Teaching Philosophy – what it is and how to write a great one, thesis statements Jigsaw wrap-up | • O’Neal et al., 2007  
• Your piece of the jigsaw  
• Final Teachable Unit                                                      |
| April 27 | Peer Review of teaching philosophy                                    | • Teaching Philosophy                                                      |
|          | Present 10 minute summary of teachable unit goals/objectives; describe activities and how they support and assess understanding |                                                                                       |
| May 4    | Backward Design – reflection on teachable units                        | • Armbruster et al., 2009  
• Wiggins & McTighe Ch 13  
• Revised Teaching Philosophy                                                  |

**Full citations for articles:**


