Course Syllabus
Secondary School Science Teaching Methods
CHEM/GEO/PHYS/ZOOL 4570
Fall 2006

Course overview:
Teaching science is something that only a few endeavor to do, and fewer still actually do well. This course is meant to give the preservice science teacher many opportunities to reflect upon and design science curricula for the classroom. However, in order to justify one’s method for teaching science, a very solid grounding in why we teach science, what we need to teach in science, and how science is learned must be established. Therefore, this class is not simply a list of lesson plans and assessment strategies, but should help the preservice teacher develop a comprehensive philosophy and approach to teaching science.

Course details:

Instructor: Dr. Adam Johnston  Dr. Sharon Ohlhorst
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Email: ajohnston@weber.edu  sohlhorst@weber.edu

Meeting place: LL 230
Meeting times: MW 11:00 AM – 11:50 AM; Th 10:00 AM – 12:50 PM
Course web page: http://physics.weber.edu/johnston/methods/
(Refer to this webpage for assignments, discussions, resources, and an up-to-date calendar.)

Major course objectives:
This course is designed with the expectation that every student who possesses the desire and drive can be successful at meeting the following objectives:
1. develop an understanding of the nature of science and scientific inquiry
2. learn applicable theory of science learning and develop resources for further research in specific areas of science education
3. understand current science education standards as well as how science curricula historically are established in public schools
4. translate educational theories into appropriate classroom strategies
5. develop instructional activities over short-term (one class period) and long-term (multi-week) timeframes.
6. evaluate science educational materials which could serve as curricular and instructional resources
7. identify approaches that accommodate learning for a diverse group of learners
8. create materials that would provide valid assessments of students’ science learning
9. develop a coherent and informed professional stance toward science teaching

Major units:
There are three major themes for this course, yet all three of these should “spiral” around one another so that no single theme is ever left behind. These are:
• The nature of science and scientific inquiry
• The nature of learning and constructivism
• Curriculum design, implementation, and assessment

Ironically, perhaps, there is no single unit that addresses “teaching” definitively, even though this is a “teaching methods” course. The act of teaching is no more a single technique than being a doctor is to sit down with a patient. In fact, it involves multiple interactions between the teacher, the curriculum, and (most important) the learner.

Grading:
Grading will be based on a varied spectrum of activities, skills, and understandings. These are designed to prepare the teacher not only to design things to do in a classroom, but also to reflect upon why and how to design such.

Professionalism.......................................................................................................................................................... 10%*
Professional behavior is expected at all times in class and while collaborating outside of class with others to complete work related to the class. These behaviors include, but are not limited to: attendance, punctuality, excellence in class assignments, constructive class participation, being a positive contributor in group work, taking advantage of opportunities to broaden personal knowledge and skills, effectively communicating with your course instructor, members of the class, and of the wider science education community. *A student who does not participate in major assignments and presentations will not receive a passing grade in the course.

**Practice and prompts**
Expect to have something to continually work on in this course. This could be a written response to a reading, a draft of your teaching philosophy, some brief research with members of a group, or the completion of some kind of laboratory assignment. All assignments will be formally given in class, and specific details (including due dates) will be laid out at the time the assignment is given.

**Projects: Lesson plans, research projects, and assessment plans**
You are to create detailed plans for teaching a science topic and/or skill to a group of secondary school students. The plan must be scientifically accurate, and educationally sound. For some lessons, you will also create tools that can be used to evaluate student understanding and instructional effectiveness. Additionally, you will have at least one opportunity to conduct your own scientific inquiry and report your findings to your peers.

**Curriculum design**
The final “capstone” project in this course will be a carefully crafted “map” of a course. More details will follow, but the basic intent is that this will be something you will actually use, in whole or in part, during your teaching experiences.

One last word about “grading”: We view grading and feedback as something that is meant to help you to continue to reflect, learn, and improve. For this reason, the final grade in this course is determined **not** by a simple averaging of scores, but by looking at where you end up. This is especially applicable to the projects/plans and curriculum design. Often, you will be giving feedback to one another, and since we are all helping each other to improve, it is important that you are both thoughtfully critical and supportive of one another.

**Important notes:**
- You are a vital part of this course and its success, and for this reason you need to show up regularly. Many other reasons exist to justify you waking up for an 11:00 AM class: First, the material covered in class is such that it is very difficult to get the same understandings and experiences on your own time outside of class. Second, there will occasionally be food and/or stuff to play with and/or assignments to hand out. Third, your grade is determined by your participation and contributions to class. Finally, at least one of your instructors (we’ll let you guess which one) is known for doing idiotic, life-threatening (to himself, not to you) labs and demonstrations, and it is always interesting to see what might happen next.
- Late work will be accepted for half credit if it is turned in within a week of its due date. Individual “dog-ate-it” and “had-to-get-married” stories will be considered on a case-by-case basis. In order to get more leniency, notify the instructor in advance of any problems you might have.
- Academic dishonesty on any work will not be tolerated. Extreme violations will result in automatic failure of the course. In this course, it is difficult to imagine what academic dishonesty would look like, since so much work is by its very nature done in groups. Be aware, however, that professionalism is a part of your course grade, and you should reflect the same integrity that you would expect from your own students.
- Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in room 181 of the Student Service Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary. You are also welcome to discuss any special needs with the instructor, though you are not required to do so.
- This is intended to be a very interactive and student centered classroom. Please help us to make it so both by participating in class and by offering suggestions as to how to better structure the class. An inherent philosophy of this class is that knowledge is constructed in social arenas, so the expectation is that there will be great inspirations and new realizations made as we interact with one another. In fact, one of the benefits of teaching
this class is that an instructor tends to learn as much (or more) from students as students should learn from instructors.

- Please do not hesitate to visit the instructor if you have any questions, concerns or comments about the course, or to discuss favorite cross-country ski routes, photography, music, poetry, physics, pottery, yeast, backpacking trails, etc. Often an instructor sits in an office, lonely and sad, during hours that should be filled with student interactions; so please feel free to drop in, even if it isn’t during a posted office hour. (The worst that could happen is you would be told to come back at another time.) Also, email tends to be an incredibly useful mechanism for getting in contact with instructors and getting your questions or comments responded to.

**Course calendar:**
Note that this calendar *will* change. Updates will be announced in class and on the course web page.

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<thead>
<tr>
<th>Monday</th>
<th>Wednesday</th>
<th>Thursday (Lab)</th>
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<tbody>
<tr>
<td><strong>Week I: 8/28</strong></td>
<td><strong>Week II: 9/4</strong></td>
<td>Lab: Science fair</td>
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<td>Course Introduction: Why are you here?</td>
<td>Debrief/discuss “Science Fair”</td>
<td>Lab: Data analysis Pendula</td>
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<td>Blowing bubbles.</td>
<td>Assign: Research Project; Lesson Plan 1</td>
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<td><strong>Week III: 9/11</strong></td>
<td><strong>Week IV: 9/18</strong></td>
<td>Pseudoscience Lab</td>
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<td>Discuss: What should/does science look like: Umbrellaolgy.</td>
<td>Bloom's taxonomy, cognitive levels, and my first lesson plan. Discuss: Bloom’s cognitive levels as they apply to lessons, the core, and the greater goal(s). Assign: Popper, etc. readings</td>
<td>A brief history of science education and intro to the state core. What is learning and higher-order thinking? Who am I as a teacher? Lab: Teaching philosophy inventory and reflection.</td>
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<td><strong>Week V: 9/25</strong></td>
<td><strong>Week VI: 10/2</strong></td>
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<td>What makes science “science”? The question of demarcation.</td>
<td>Present/discuss Research Projects Assign: Letter to a concerned parent</td>
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<td><strong>Week VI: 10/2</strong></td>
<td>Present Research Project</td>
<td>Science vs. Religion: Cohesion, conflict, or something else? Observation &amp; inference: The case of the tracks and other dilemmas.</td>
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<td>Week VIII: 10/16</td>
<td>What makes learning &quot;learning&quot;? Constructivism and conceptual change.</td>
<td>Present lesson plan 2</td>
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<td>Week IX: 10/23</td>
<td>Present lesson plan 2 Assign: Watson &amp; Konicek reading (&quot;Teaching for Conceptual Change&quot;)</td>
<td>Present lesson plan 2 A science fair presentation.</td>
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<td>Week X: 10/30</td>
<td>Discussion: Conceptual change and the role of teaching.</td>
<td>Guest: USOE Science Assessment Specialist</td>
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<td>Week XI: 11/5</td>
<td>Present Assessment measures</td>
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<td>Week XII: 11/12</td>
<td>Deductive and inductive modes of teaching; Intro to inquiry learning Assign: Lesson plan 3</td>
<td>Inquiry into inquiry</td>
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<td>Week XIV: 11/27</td>
<td>Present Lesson Plan #3</td>
<td>Guest: USOE Science Curriculum Specialist</td>
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