Course Description:
The main purpose of this course is to introduce prospective science teachers to key ideas associated with teaching science at the secondary level. Teaching science effectively requires that teachers attend to the prior ideas that students bring with them into the classroom, that teachers provide experiences that allow students to construct their own knowledge, and that teachers pay careful attention to state and national guidelines about what needs to be taught. This course will introduce you to these fundamentals as a foundation for your professional education program including methods courses and teaching practica.

This introductory course is closely aligned with the Secondary Science Methods course SCED 491. In the present course, we will mostly discuss the fundamental ideas behind teaching science. All of the topics we cover will be developed in more detail in SCED 491 where we will also cover more of the “nuts-and-bolts” of teaching science (managing labs, practicing inquiry, doing demos, science assessment, etc.).

The format of the course is a mixture of lecture/lab activity and discussion. During the first hour of the class, you will participate in an activity centered on that day’s topic. The second hour of the class will be devoted to a discussion of the readings for that day. It is imperative that you come to class having done the readings.

Texts:
Although there are no “textbooks” in the traditional sense for this course, there are two books you should obtain:

- How People Learn: Bridging Research and Practice (National Academy Press, 1999)
- Teaching High School Science Through Inquiry (Llewellyn, 2004; Corbin Press)

You also need to become familiar with Next Generation Science Standards. [http://www.nextgenscience.org/next-generation-science-standards](http://www.nextgenscience.org/next-generation-science-standards). Throughout the quarter, readings will be assigned from these books and from other materials, all of which will be linked to the Canvas course or can be found in the LRC. Each of the reading assignments will be tied to a discussion. These books will be used again in SCED 491.

Prerequisites: CHEM 123 or CHEM 225 or GEOL 212 or BIOL 206 or PHYS 163

Course Outcomes and Goals:
The major goals of this course are
(1) to develop a better understanding of the nature of science
(2) to explore current research on how people learn
(3) to become acquainted with state and national science standards and their roles in science education
(4) to become well-versed on the research behind, and practices or, effective science teaching and learning

These goals will be accomplished in a variety of ways including: (1) exploring and adapting a science lesson appropriate within the 7-12 grade range that incorporates all the key elements of effective science teaching, (2) class discussions on issues related to science instruction, e.g., processes of science, constructivism, etc., (3) review and application of the state and national science standards, (4) becoming aware of professional organizations for science teachers, and (5) review of existing science curricula.
**Requirements**
Science Education 481 demands active participation and a willingness to learn and explore teaching and learning science. It is an investigation-intensive class and will require all students to be prepared each day. Excellent attendance is essential for success in this course.

**Assignments and Assessments:**
You will have a number of different assignments over the quarter. Most are due one week after they are assigned.

**Discussion Questions (16%)**: You are responsible for submitting questions or points for discussion to me before each discussion. These questions must be given to me at the beginning of each class and cannot be accepted for a missed class.

**Participation (10%)**: Science Education 481 demands active participation and a willingness to learn and explore teaching and learning science. It is an investigation-intensive class and it will only succeed if all students are prepared each day. The class will become what you make of it. Participation grade is based on your preparedness and contributions during class. Since we only have 10 meetings, missing class without a valid excuse (such as illness or other emergency) will significantly impact your participation grade.

**SCED 20x Observation (or other science class with permission) (9%)**
You will attend 3 hours (3 different meetings) of any SCED 20X class, either: **SCED 201 (physics)**: MWF 12-1:50 (Boudreaux, SL240); **SCED 202 (geology)**: MWF 10-11:50 (Filer, SL 210); or **SCED 204 (chemistry)**: MWF 2-3:50 (Borda, SL 210).
- Attend three different sessions, but you need only stay for one of the two hours of each session.
- Schedule your observations with instructors in advance
- Participation involves directed observations, listening to student questions and short pedagogical debriefs with instructors as time allows.
- You will use the modified MORE rubric for your observation

**Standards Assignment (10%)**: You will explore the Next Generation Science Standards for your topic of choice. This topic will be the focus of several assignments in this course. It is due the week after it is assigned.

**Preconceptions (5%)**: You will use different sources to identify common prior ideas for a topic of your choice. It is due the week after it is assigned.

**Assessment Probe (5%)**: You will develop a probe that assesses for common prior ideas for a topic of your choice. It is due the week after it is assigned.

**Concept Map/Learning Progression (5%)**: You will construct a concept map or learning progression about a topic of your choice. It is due the week after it is assigned.

**Lesson Revision (20%)**: You will find one standard lesson on your topic and revise it to address the important aspects of teaching science, using the EdTPA lesson plan format.

**Reflective Paper (20%)**: You will write a reflective essay. This is meant to be a broad essay about the teaching of science and should be 3-5 pages long, double-spaced, using 12 point font.

**Grading:**

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>95% - 100%</td>
<td>A</td>
</tr>
<tr>
<td>90% - 94%</td>
<td>A-</td>
</tr>
<tr>
<td>87% - 89.9%</td>
<td>B+</td>
</tr>
<tr>
<td>83% - 86.9%</td>
<td>B</td>
</tr>
<tr>
<td>80% - 82.9%</td>
<td>B-</td>
</tr>
<tr>
<td>77% - 79.9%</td>
<td>C+</td>
</tr>
<tr>
<td>72% - 76.9%</td>
<td>C</td>
</tr>
<tr>
<td>70% - 71.9%</td>
<td>C-</td>
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Course Relationship to Teacher Preparation Standards:

**Content Pedagogy:** The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and can create meaningful experiences that make these aspects of subject matter meaningful to students.

**Diverse Learners:** The teacher understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse learners.

**Communication and Technology:** The teacher-in-training uses knowledge of effective verbal, nonverbal and media communication techniques to foster active inquiry, collaboration and supportive interaction in the classroom.

**Planning:** The teacher plans instruction based upon knowledge of subject matter, students, the community, and curriculum goals.

Other Important Notes

**Reasonable Accommodation**
Reasonable accommodation for persons with documented disabilities should be established within the first week of class and arranged through Disability Resources for Students: telephone 650-3083; email drs@wwu.edu; and on the web at [http://www.wwu.edu/depts/drs/](http://www.wwu.edu/depts/drs/)

**Student Services**
Western encourages students to seek assistance and support at the onset of an illness, difficulty, or crisis.

- In the case of a medical concern or question, please contact the Health Center: 650-3400 or [wwu.edu/chw/student_health/](http://www.wwu.edu/chw/student_health/)
- In the case of an emotional or psychological concern or question, please contact the Counseling Center: 650-3400 or [wwu.edu/chw](http://www.wwu.edu/chw)
- In the case of a health and safety concern, please contact the University Police: 650-3555 or [www.wwu.edu/ps/](http://www.wwu.edu/ps/)
- In the case of a family or personal crisis or emergency, please contact the Office of Student Life: 650-3706 or [http://www.wwu.edu/dos/office/slo_student_assistance.shtml](http://www.wwu.edu/dos/office/slo_student_assistance.shtml)

**Integrity**
As a community, Western is committed to integrity in all aspects of academic and campus life. An excellent resource for guiding students is Western’s newly created Integrity website. (See [http://www.wwu.edu/integrity/](http://www.wwu.edu/integrity/) )
This site is a clearinghouse of resources that encourages and educates about integrity. Besides covering more common problems related to academic integrity, such as plagiarism and cheating on exams, it also addresses ambiguous areas, such as collaborative work, the use of language translators, and submitting the same paper in different classes. In addition to this site, the University Catalog in Appendix D—Academic Honesty Policy and Procedure—delineates rights and responsibilities. ([http://catalog.wwu.edu/content.php?catoid=10&navoid=1794](http://catalog.wwu.edu/content.php?catoid=10&navoid=1794))

This syllabus is subject to change. Changes, if any, will be announced in class. Students will be held responsible for all changes announced in class.
<table>
<thead>
<tr>
<th>When</th>
<th>Topic</th>
<th>Reading Assignments: on Canvas, unless indicated</th>
<th>Assignments Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>Nature of Science</td>
<td></td>
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</tr>
<tr>
<td>Jan 5</td>
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</tbody>
</table>
| WEEK 2     | Nature of Science      | • AAAS Science for All Americans, Ch. 1 & 12 http://www.project2061.org/publications/sfaa/online/sfaatoc.htm  
| Jan 12     |                        |                                                 |                 |
| WEEK 3     | Constructivism         | • National Academy Press (1999): How People Learn: Bridging Research and Practice, Ch 1&2  
| Jan 19     |                        |                                                 |                 |
• Choose one disciplinary NGSS reading  
  o Cooper, MM (2013) Chemistry  
  o Wysession (2013) Earth Science  
  o Bybee (2013) Life Science  
• Krajcik et al. (2014) Planning Instruction to Meet the Intent of the NGSS. | Choose topic for assignments (this will be done in class) Latest date for Observation #1 |
| Jan 26     |                        |                                                 |                 |
| WEEK 5     | Prior Knowledge        | • Making Sense of Secondary Science (Driver et al.) Introduction (on reserve in the LRC)  
• Coley and Tanner (2012) (Biology) or other discipline based reading:  
  o Francek (2013) (Geoscience)  
  o Garnett et al (2015) (Chemistry) | Standards Assignment Latest date for Observation #2 |
| Feb 2      |                        |                                                 |                 |
| WEEK 6     | Formative Assessment   | • Popham, ch2, Learning Progressions (&notetaking form)  
• Formative assessment - so many awesome ones to choose from, I’ll decide between these later:  
  o Stiggins (2007)  
  o Black and Wiliam (1998) Inside the black box  
  o Creighton et al. (2015) p. 5-11  
  o Banilower (2010) p. 18-19 | Preconceptions Assignment |
| Feb 9      |                        |                                                 |                 |
| WEEK 7     | Big Ideas in Science   | • Project 2061 Designs for Scientific Literacy, Ch. 7 – Unburdening the Curriculum  
• Wiggins (2010) Big Ideas | Probe Latest date for Observation #3 |
| Feb 16     |                        |                                                 |                 |
| WEEK 8     | Inquiry                | • Teaching High School Science Through Inquiry (Llwellyn) Ch. 1, 3, & 4 (on reserve in the LRC)  
• Banilower (2010) p. 19-30 (analysis)  
• Other reading TBA | Concept Map or Learning Progression |
| Feb 23     |                        |                                                 |                 |
| WEEK 9     | Inquiry                | • Teaching High School Science Through Inquiry (Llwellyn) Ch. 5 & 6 (on reserve in the LRC)  
• Other reading TBA |                             |
| Mar 1      |                        |                                                 |                 |
| WEEK 10    | Teaching Science & ELL | • Taking Science to School (Ch. 1 & 2) http://www.nap.edu/catalog.php?record_id=11625  
• Quinn et al. (2012) Language Demands and Opportunities in Relation to NGSS for English Language Learners: What Teachers Need to Know | Lesson Revision/ Reflective Essay |
| Mar 8      |                        |                                                 |                 |