

**SCED 441**  
**Methods of Teaching Secondary School Science**  
**Fall 2013**  
**MW 6:30 – 7:45 p.m.**

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**Hours:** MTWF 12:00 – 1:00, MW 2:30 – 3:45 and by appointment  
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### Course Description

This course will be integrated with your field experience in STEP 363/EDFE 554. In the context of a real classroom this course will help students become familiar with the professional responsibilities of teaching science in the secondary school setting. Common problems and methodologies of teaching science to secondary school students will be discussed. The course will also provide entry level operational knowledge of the instructional strategies, techniques, and materials available for secondary science by having students design learning units, explore learning materials, and analyze teaching styles. The use of modern technology in the classroom will also be discussed.

This course provides content necessary to enable teacher licensure students to address [Colorado P-12 Academic Standards in Science](#).

### Online Resources:

- National Academies Press: A Framework for K-12 Science Education
  - [http://www.nap.edu/catalog.php?record\\_id=13165](http://www.nap.edu/catalog.php?record_id=13165)
- Next Generation Science Standards
  - <http://www.nextgenscience.org/next-generation-science-standards>
- National Science Education Standards
  - [http://www.nap.edu/openbook.php?record\\_id=4962](http://www.nap.edu/openbook.php?record_id=4962)
- Classroom Assessment and the National Science Education Standards
  - [http://www.nap.edu/catalog.php?record\\_id=9847](http://www.nap.edu/catalog.php?record_id=9847)
- How People Learn: Brain, Mind, Experience, and School
  - [http://books.nap.edu/catalog.php?record\\_id=9853](http://books.nap.edu/catalog.php?record_id=9853)
- How students learn: Science in the classroom
  - [http://www.nap.edu/catalog.php?record\\_id=11102](http://www.nap.edu/catalog.php?record_id=11102)
- American Association for the Advancement of Science (AAAS) publications
  - <http://www.project2061.org/publications/>
- AAAS Project 2061 Benchmarks for Science Literacy, Science for All Americans
  - Atlas science literacy maps (National Science Digital Library, <http://strandmaps.nsdlib.org/>)
- Vision and Change in Undergraduate Biology Education: A Call to Action
  - <http://visionandchange.org/finalreport>
- Video Resources: Annenberg Media ([www.learner.org](http://www.learner.org)), HHMI
- Interactive Labs from Brigham Young University [Click here to view Public](#).

**Anticipated Course Learning Outcomes:** Teacher candidates will be able to:

- **Feel** like a professional teacher (dispositions)
- Use best practices in science teaching
- Identify common preconceptions students have about science concepts.
- Plan coherent and effective instructional sequences that are consistent with the goals of the *Next Generation Science Standards* and *Colorado Academic Standards for Science*.

- Conduct discourse and questioning
  - Facilitate effective group work
  - Deliver effective demonstrations
  - Use multiple forms of technology to enhance the effectiveness of their teaching.
  - Create a safe learning environment which includes laboratory safety.
  - Plan activities that keep students engaged.
  - Employ various classroom management techniques.
  - regularly reflect on their teaching and make changes based on these reflections.
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- Define data driven instruction.
  - Use formative assessment to adjust to students' needs as they are teaching and to determine where instruction can be improved next time. (Backwards Planning)
  - Use summative assessment to determine student level of mastery.
  - Use pre/post-tests to determine change, learning gains and effect size by gender and ELL.
  - Create a box and whiskers graph from a set of test scores.
  - Use CSAP/TCAP data to drive instruction. (Data driven instruction)
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- Define the various aspects that constitute the nature of science
    - Asking questions and defining problems
    - Developing and using models (physical, computer simulation, educational vs. experimental)
    - Planning and carrying out investigations
    - Analyzing and interpreting data
    - Using mathematics and computational thinking
    - Constructing explanations
    - Engaging in argument from evidence - skepticism
    - Obtaining, evaluating, and communicating information
    - applications and limitations of the idealized scientific method
    - using hypothesis only when appropriate
  - Develop and teach lessons which explicitly address the various aspects of the nature of science.
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- Write a lesson plan that addresses appropriate Colorado model content standards, includes assessable learning goals, modifications for various students, formative assessment and adequate description for a substitute.
  - Write a complete Work Sample including: full lesson plans for each day of the unit, pre/post assessment and analysis of the entire unit, reflect on the unit using classroom experience and pre/post data to determine how it can be improved.
  - Plan days, weeks and full years of curriculum.
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- Describe a variety of professional teaching activities and organizations available to Colorado science teachers.

### Course Evaluation

**A** - In addition to carefully completing all course goals and fully participating in all discussions and field experiences, an "A" in the methods class indicates that a student is extremely well qualified in terms of teaching skills and possesses the ability to be outstanding during student teaching. This student displays quality planning, interacts well with students, shows command of subject matter and has the ability and knowledge to discuss a number of issues in science education. This student shows creative flair as well as a strong commitment to education. This individual is well on the way to becoming a formal operational teacher. Furthermore, all of the above criteria have been systematically documented and presented in his or her portfolio and during the Celebration of Learning.

**B** - In addition to completing all assignments and participating in all field experiences, a "B" indicates that this student possesses ability to plan, interact and deal with issues in science education. This individual understands the subject matter and can implement effective lessons. Both the portfolio and the Celebration of Learning indicate areas of need that the student has identified and established a plan of action to correct.

**C** - This person possesses the basic competencies deemed necessary for science teaching. It is assumed that all course goals have been completed. This student may be quite successful in some areas and not so successful in others. A "C" student may need special attention during student teaching to insure success and licensure. The portfolio and the Celebration of Learning presentation should indicate areas of need but the student may not have developed a well thought out plan of action for further professional development.

**D** - A "D" grade indicates that the student is unsuccessful with the basic competencies even though this individual can direct a classroom given support and directions. This student may have achieved many of the course goals, but does not possess the basic competencies necessary to student teach. The portfolio and the celebration of learning presentation will show areas of accomplishment and how these skills will be redirected toward another career choice or how the student will back up and correct these deficiencies before being allowed to continue into student teaching.

**F** - Complete failure early in the term will signal a grade of "F." This individual will be counseled to drop the class and redirect their professional goals based on individual strengths.

### **Student Expectations**

Students are expected to

- regularly attend class.
- keep a portfolio of the activities and assignments of this class.
- read assignments.
- participate in classroom discussions and activities.
- turn in assignments on announced dates.

### **\*\*IMPORTANT\*\***

- Since this is a professional training class, students are expected to treat their obligations to this class the same as they would their professional teaching obligations.

### **Major Activities**

- Weekly Reflections on 363/554 observations – 15 min class discussion
- Clinical Log of 363/554 observations - turn in at the end of the semester
- Simulated guided inquiry lesson with pre/post and lesson plan
- Nature of Science lessons and discussions scattered throughout semester
- Education Research results scattered throughout the semester and used to support methods
- 2 lesson plans – early in the semester. Must contain: Assessable learning goals, CO content standards (cut and paste & highlight those that apply), required materials, safety considerations, walk through a sub could use with Closure (Make sure 5 e's are addressed and in appropriate order), assessment, accommodations (done early, disabilities etc.. must be productive), Subject Integration. Note time for each section. (may consider three columns teachers does, students do and modifications)
  - Lesson plan for a video lesson or inquiry lesson demonstrated in class
- Video tape lesson early (2 if time allows). Part of 363 assignments.
- Demo show – Professional meeting if possible. (CSC fall, Longs Peak Sci Fair Spring or AAPT sectional meeting?)
- Review Scientific Article on Education Research
- Data project – use CSAP data to drive instruction ie Nature of Science , Box and whiskers
- Lab Safety Day
- Preliminary Work sample

- 5 classes minimum written up in full lesson plan format. All materials that will be used included pre/post test, slides, worksheets must be turned in. references
- Collect pre/post data for at least one class period and analyze.
- Set up w/ host teacher in the beginning of the semester to teach at least 5 consecutive class periods .
- Reflection on how the lessons that were taught went and using formative assessment including the pre/post-test results, suggest ways to improve the unit.
- Celebration of learning

**Topics to be discussed in the course will include.**

- Presenting science materials – Active Engagement
  - How students learn science.
  - Types of science instruction.
  - What it means to “do science”
  - Leading a classroom discussion.
  - Preparing and presenting a classroom activity or demonstration.
  - Designing effective classroom activities and laboratories.
- Laboratory and science classroom safety.
- Organizing materials for good classroom management and discipline.
- Planning science instruction.
  - Daily instruction.
  - Unit (weekly) instruction.
  - Yearly instruction (developing a course plan)
- Teaching in a standards based classroom
- Evaluating student progress and achievement.
  - Types of evaluation (formative, summative, diagnostic)
  - Methods of evaluation (daily work, laboratory, quiz, test)
- Using modern technology appropriately and effectively in the curriculum.
  - computers
  - power point
  - clickers
  - video
  - Smart boards
- Becoming a "Professional" teacher.
  - Developing personal resources.
  - Science teacher organizations (local, state, national).
  - Additional course work.

**Science Methods/Clinical Experiences**

While enrolled in SCED 441 you are concurrently enrolled in STEP 363/EDFE 554. These two courses are corequisites and the success of each is dependent on the other. STEP 363/EDFE 554 is a clinical/field experience that allows you to practice much of what will be discussed in SCED 441. The experience should be developmental, **culminating in an extended teaching experience of at least 5 consecutive days.** You will work closely with your cooperating teacher to develop your teaching skills. Take every opportunity to work with students that is available to you.

You will have expectations for what is done during your field experience from both the College of Education/Partnership Faculty and SCED 441. Where these are redundant or very closely aligned, doing the once, excellently is sufficient. **Remember, our ultimate goal is to prepare you to be an excellent teacher. This is not just a course; it is the gateway to your profession.**

Following is a suggested progression of expectations for your clinical experience. This is designed to gradually get you more involved with students and increase your classroom leadership as the semester progresses. In addition to these, there will be specific observational tasks assigned during the semester that

will correspond with topics covered in class. Your STEP 363 instructors may make additional assignments. Your cooperating teacher will have additional expectations. You personally should seek responsibility and active involvement in the teaching profession. The goal is to maximize your growth as a science educator through involvement with a high school or middle school science class. Many times it is up to you to initiate this involvement.

This is a professional position. Your active involvement and completion of responsibilities is assumed. If you cannot attend your clinical class, notify your cooperating teacher ahead of time.

Please share these expectations with your cooperating teacher. He/she will very likely have additional expectations, but these should form a core for initiating involvement. Build on these as you develop your professional skills.

### **RECOMMENDED CLINICAL EXPERIENCES**

1. Learn students' names
2. Write and share observations of class sessions and particular students in assigned classes.
3. Assist with: Taking roll, reading bulletins, Handing out papers, Setting up and breaking down laboratory experiments
4. Grading student papers
5. Be familiar with school policies and procedures
6. Create a bulletin board and/or window display
7. Be involved with students in one-on-one and small group settings
8. Observe and document one student over the semester. Regularly log records on behaviors, interactions, class performance, physical changes, emotional reactions, and special needs.
9. Make explicit lesson plans based on student needs
10. Teach as many lessons or portions of lessons as possible
11. Plan and teach at least one topic area or complete unit as described in more detail in the major activity section.
12. Time to reflect on experiences as a "Teacher Assistant"
13. Experience Team Teaching not just turn teaching
14. Demonstrate the use of checks for understanding
15. Follow one student for as much of an entire school day as possible, then document and react to your findings.