

Oregon State University
Professional Teacher Preparation Program
SED 577: Science Pedagogy II (3 cr.) - Winter, 2010

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Office hours after class and by appointment

Monday & Wednesday 9:00-10:50 AM
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Course Catalog Description

SED 577: Development of additional pedagogical content knowledge in grades 3-12; stress on dominate themes in national reforms including inquiry and nature of science.

Overview

Welcome to the second of two content specific courses in the Master's of Science Degree in the Department of Science & Mathematics Education (Science) and Teacher & Counselor Education (Education) at OSU. This course fosters a reexamination of science teaching methods in relation to the structure of the discipline and the nature of scientific inquiry. A focus is the conceptualization of inquiry methods in science in relation to an understanding of authentic inquiry in professional science. In addition to scientific inquiry, additional methods such as the use of analogies, demonstrations, and concept maps, will be explored.

Learning Outcomes

Upon completion of this course, you will be better at:

1. Recognizing characteristics of and employing strategies for **teaching science as inquiry**.
2. Designing instruction with the *explicit* purpose of **supporting learning of both content and learning skills**.
3. Utilizing multiple instructional strategies to **enable students to build conceptual understanding**.
4. Designing instruction that motivates interest in science by being **culturally sensitive and developmentally appropriate**.
5. **Presenting and defending** beliefs about science teaching and learning based on the understandings in the course.

Course process outcomes: Upon completion of this course, you will be better at:

6. **Reading and discussing text material** with respect to course understandings.
7. **Reading and discussing empirical and theoretical research** reports with respect to course understandings.
8. **Making thoughtful and constructive comments** related to the merits, shortcomings, and disagreements about the acts of teaching observed in yourself and others.
9. Developing a **specialized knowledge of science for teaching**.
10. Utilizing the **specialized vocabulary of science education** in a professional context.

Reading Material

- Luft, J., Bell, R., & Gess-Newsome, J. (Eds.). (2008). *Science as inquiry in the secondary setting*. Arlington, VA: NSTA Press.
- National Research Council. (2000). *Inquiry and the National Science Education Standards: A Guide for Teaching and Learning*. (S. Olson & S. Loucks-Horsley, Eds.). Washington, D.C.: National Academy Press.

Supporting Materials

- Oregon Department of Education (2006). *Oregon Standards*. Salem, OR: Author. Oregon revised science academic content standards.
 - Go to the following web page and click “Standards by design.” You can get science standards for the specific grade that you want to know.
<http://www.ode.state.or.us/search/page/?id=1577>
- National Research Council (1996). *National science education standards*. Washington, D. C.: National Academy Press. Presentation of the national principles and standards for science that addresses all levels of learners. <http://www.nap.edu/readingroom/books/nse>
- Marzano, R. J., Pickering, D. J., and Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Wiggins & McTighe (1998). *Understanding by Design*. Alexandria, VA: Association for Supervision and Curriculum Development
- *The Science Teacher* or *Science Scope* subscription with NSTA membership.
- Additional papers will be announced in class.

Evaluation of Student Performance

Professional Disposition (see Course Assignments & Syllabus) Attendance, Reading Responses, In-class individual and group work, Microteaching activities, Community Responsibilities (see Performance Tasks in Syllabus)	20%
Content Area Project	30%
Middle School Challenge Lesson	10%
Science as Story Project	10%
Extended Inquiry Project	30%
TOTAL	100%

Statement Regarding Students with Disabilities

Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but

who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.
<http://oregonstate.edu/dept/budgets/genupol/gupdissu.htm>

Link to Statement of Expectations for Student Conduct

<http://oregonstate.edu/admin/stucon/achon.htm>

Academic Integrity — Students are expected to comply with all regulations pertaining to academic honesty, defined as: *An intentional act of deception in which a student seeks to claim credit for the work or effort of another person or uses unauthorized materials or fabricated information in any academic work.* For further information, visit [Avoiding Academic Dishonesty](#), or contact the office of Student Conduct and Mediation at 541-737-3656.

Link to Conceptual Framework, Knowledge Base, and National and State Teaching Standards

The Professional Teacher and Counselor Education (PTCE) unit Conceptual Framework is based on four foundational or core values that are listed below. To find out more about how the knowledge base relates to the National Council for Accreditation of Teacher Education (NCATE) guidelines, review the Conceptual Framework at the website: <http://oregonstate.edu/education/accreditation/>

1. Ethics and Professionalism
2. Reflective Practitioner
3. Lifelong Learners
4. Diversity and Equity

With respect to national standards, this course includes application of NCATE content knowledge, professional and pedagogical knowledge and skills, dispositions, and student learning. NCATE Unit Standards: <http://www.ncate.org/public/unitStandardsRubrics.asp?ch=4>

Of the five Oregon TSPC Standards those indicated are most emphasized in this course:

- Standard 1: Plan Instruction that supports student progress in learning and is appropriate for the developmental level.
- Standard 2: Establish a classroom climate conducive to learning.
- Standard 3: Engage students in planned learning activities.
- Standard 4: Evaluate, act upon, and report student progress in learning.
- Standard 5: Exhibits professional behaviors, ethics, and values.

General Criteria

The “A” paper demonstrates knowledge of text material, guest speakers, class discussion, and content of other assigned readings through writing that shows clear evidence of analysis and synthesis of central concepts. The paper uses uncomplicated prose supported by meaningful subheadings to guide the reader to the main points. The paper is free of undefined and unclear terms. The development of ideas closely supports the purpose that is stated early in the paper. It is handed in by the due date or prior arrangements made.

The “B” paper demonstrates knowledge of text material, guest speakers, class discussion, and content of other assigned readings through writing that shows clear evidence of comprehension of central concepts but lacks depth of meaning required of a true synthesis. The paper occasionally uses educational or psychological jargon that reduces the clarity of ideas. The paper is made more readable and ideas are clearer because of meaningful subheadings that guide the reader to the main points. The development of ideas are related to the purpose but the focus and clarity leave aspects of the paper unclear, e.g. undefined jargon terms and skips points in the argument. It is handed in by the due date or prior arrangements made.

The paper rated at “C” or below shows some deficiencies in comprehending central concepts related to knowledge from text material and/or content of other readings and class discussions. The writing style tends to obscure main points and the development of ideas does not clearly support the purpose of the paper. Key points are left out. Papers handed in late without prior arrangement will receive a lowered grade.

Letter grades are based on the approximate range:

A ≥ 90%	exceptional performance
B ≥ 80%	graduate level competence
C ≥ 70%	below acceptable graduate level work
D ≥ 60%	serious deficiencies

Established Goals

Development of pedagogical content knowledge (PCK) in grades 6-12 science instruction. PCK labels the *kinds of knowledge required for teaching science* that extends beyond content knowledge in science. PCK would include a combination of knowledge of the nature of science, science instruction and student learning along with relevant knowledge of science. Teachers come to know PCK as “knowledge in action”, knowledge about and for teaching. See Target descriptions of NCATE Standard 1: 1a, 1b, 1c, and 1d.

Enduring Understandings

- A Certain instructional techniques such as the use of analogies, demonstrations, and laboratory exercises are essential to the science classroom and can be used to expand and enrich scientific inquiry.
- B The aim of doing more authentic science in schools is to develop the depth of content knowledge, the habits of mind, and the critical reasoning skills that are crucial to basic science literacy.
- C Students hold points of view about the world and hold conceptions about how the world works before they enter the science classroom that will affect their learning and have implications for teaching.
- D Scientists engage in a wide range of activities that are not accurately represented by the traditional “scientific method.”
- E Scientists are ultimately engaged in developing persuasive arguments around competing explanations for natural occurrences using evidence gathered from a wide variety of data gathering techniques.
- F Inquiry must begin with a tentative explanation for a puzzling or otherwise motivating problem with which students can engage, collect evidence for, and present an argument based on that evidence.
- G Although the activities provide the critical context for learning the content, the science-specific discourse moves students’ thinking forward about that content.
- H Inquiry in the classroom can be teacher-led, student-led, or somewhere in between based on the purpose of the inquiry and student readiness.
- I Authentic scientific inquiry differs among the various fields and disciplines of science.
- J Stories from the history of science and current science provide context for the science content.

Tentative Outline Winter 2010

Week	Essential Question(s)
January 4 th & 6 th	<ul style="list-style-type: none"> • How does what we did last term relate to what we are going to do this term? • What instructional techniques are unique to the science classroom?
January 11 th & 13 th	<ul style="list-style-type: none"> • What instructional techniques are unique to the science classroom?
January 20 th	<ul style="list-style-type: none"> • What instructional techniques are unique to the science classroom?
January 25 th & 27 th	<ul style="list-style-type: none"> • What instructional techniques are unique to the science classroom?
February 1 st & 3 rd	<ul style="list-style-type: none"> • Is the “scientific method” valid? • How does inquiry in the classroom relate to inquiry in science? • What are the essential features of scientific inquiry? • What models of inquiry exist for teachers? • What are the advantages / disadvantages of model-based inquiry?
February 8 th & 10 th	<ul style="list-style-type: none"> • How is MBI planned and implemented in the classroom? • How is discourse important in inquiry? • What are the different ways data can be generated in science? • What is an authentic scientific argument in the science classroom?
February 15 th & 17 th	<ul style="list-style-type: none"> • What does inquiry look like in the earth sciences?

	<ul style="list-style-type: none">• What does inquiry look like in chemistry?• What does inquiry look like in biology?• What does inquiry look like in physics?
February 22 nd & 24 th	<ul style="list-style-type: none">• (Prepare for Middle School Challenge)
March 1 st & 3 rd	<ul style="list-style-type: none">• How can we assess inquiry?• How can the history of science be used to provide context for science content?
March 8 th & 10 th	<ul style="list-style-type: none">• (Prepare extended inquiry Project)

Performance Tasks

The assignments described in this syllabus with the indicated alignment, with course performance indicators, describe the desired evidence of learning.

Other Evidence Includes...

Written and verbal responses that are:

- a. Thoughtful – indicate reading course materials with “understanding” and integration with other ideas and experiences the preservice teacher brings to the course.
- b. Reflective – indicate intentional and purposeful comparison and contrasting of ideas in light of course understandings.
- c. Constructive – indicate a supportive intention to promote learning by self and others and to build on the ideas of others and ideas presented in the course.

Behaviors inside and outside the classroom that are:

- a. Collegial – sharing responsibility among the cohort, staff, and faculty.
- b. Supportive – expressing interest in the advancement of everyone involved in the program: at OSU, the schools, and community.

Anticipated Misunderstandings

Preservice teachers will think that:

- a. Teaching primarily means telling students about science.
- b. Planning for teaching primarily means finding the right activities.
- c. Students already know how to read effectively to handle text and other readings.
- d. Students already know how to think effectively to learn from classroom activities.
- e. Activities and strategies pulled from text and other professional material are immediately understandable by all students who are trying to learn.
- f. Student expression, written or spoken, is to be judged mostly right or mostly wrong based on the teacher’s intended understandings.
- g. Teaching is an activity almost exclusively between the teacher and a classroom of students.
- h. Quick responses are a good indicator of intelligence and learning.
- i. “Hands-on” is the same as inquiry.
- j. The “scientific method” provides a reasonably authentic image of professional science.
- k. By doing carefully chosen activities students will understand how science is done.