

Oregon State University
Professional Teacher Education Master's Program
SED 577: Science Pedagogy & Technology II (4 cr.)
Winter 2011

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Office hours after class and by appointment

Monday & Wednesday 8:00 – 9:50am
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Course Catalog Description

SED 577: Development of additional pedagogical content knowledge for grades 6-12; stress on dominant themes in national reforms including inquiry and nature of science, as well as the integration of technology into the science classroom.

Overview

Welcome to the second of two content specific courses in the Master's of Science in Science Education Degree in the Department of Science & Mathematics Education. This course fosters an examination of science teaching methods in relation to the structure of the discipline and the nature of scientific inquiry. A focus is on teaching science as inquiry and providing authentic scientific experiences to students. The use of technology in the science classroom is also a focus of the term.

Learning Outcomes

Specific enduring understandings of the course series (**bold** items indicate Winter term):

- There are specific instructional strategies unique to science education that assists students in understanding complex and/or abstract scientific concepts.
- **Big ideas in science anchor the curriculum and pave the way for building understanding.**
- Students hold points of view about the world and hold conceptions about how the world works before they enter the classroom that will affect their learning and have implications for teaching.
- Developing understanding involves use of metacognitive skills, requires effort, takes time, practice, and improves with time. Students must be explicitly supported for this kind of learning.
- All learners make sense of science ideas primarily through talking with others and teachers must develop systematic ways to engage students in specific kinds of discourse.
- **There is much more to science education than the content of science. The nature and history of science can be used to provide context for scientific concepts and should be explicit learning goals in their own right.**
- **The state of Oregon has specific requirements for science teachers including content standards, state exams, and inquiry work samples.**
- Lesson planning is based on the skills, beliefs, and understandings of teachers and affects what students learn.
- Lessons should be focused on the learning experiences of students rather than on the teacher's organization and delivery of the lesson.
- There are many resources available to science teachers including professional organizations and publications.
- **The term inquiry has two distinct meanings. First is refers to the diverse ways in which scientists study the natural world and propose explanations based on evidence. It also**

refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. These two definitions are linked in the science classroom.

- Scientists engage in a wide range of activities that are not accurately represented by the traditional “scientific method” but are central to doing research.
- Inquiry in the classroom requires that the students are engaged by scientifically oriented questions, give priority to evidence, formulate explanations from that evidence, evaluate their explanations in light of alternative explanations, and communicate and justify their explanations.
- Utilizing evidence in reasoning is essential to science and science education.
- Inquiry in the classroom can be teacher-led, student-led, or somewhere in between based on the purpose of the instruction and student readiness.
- It is the responsibility of teachers to help children from all cultural and linguistic backgrounds meet high expectations for learning.
- The proper integration of technology into teaching can lead to better concept understanding and motivation in students as well as provide more authentic laboratory and inquiry experiences.

Upon completion of this course, you will be better at (**bold** items indicate Fall term):

- Effectively utilize specific instructional strategies for providing meaningful experiences for your students.
- **Identify and utilize big ideas in science**
- Writing a lucid rationale for teaching selected science content that makes a case for its age-appropriateness, its value to society, and its meaning for students.
- Designing meaningful lesson plans focused on student learning experiences.
- Recognizing student misconceptions and designing experiences to challenge those misconceptions.
- **Designing and scoring a state inquiry work sample.**
- **Presenting and defending beliefs about science teaching and learning based on the understandings of the course.**
- **Recognizing characteristics of and employing strategies for teaching science as inquiry.**
- **Designing instruction that motivates interest in science by being culturally sensitive and developmentally appropriate.**
- **Integrating technology into your lessons.**

Reading Material

- Grinnell, F. (2009). *Everyday Practice of Science: Where Intuition and Passion Meet Objectivity and Logic*. New York: Oxford University Press.
- 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 (2009). *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, Community Responsibilities (see Performance Tasks in Syllabus)	10%
Reflections on Inquiry Papers	20%
Microteaching Assignments	20%
Work Sample Unit Plan	10%
Extended Inquiry Project	30%
Final Exam	10%
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

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:

- Teaching primarily means telling students about science.
- Planning for teaching primarily means finding the right activities.
- Students already know how to read and think effectively to learn from classroom activities.
- Activities and strategies pulled from text and other professional material are immediately understandable by all students who are trying to learn.
- Student expression, written or spoken, is to be judged mostly right or mostly wrong based on the teacher’s intended understandings.
- Teaching is an activity almost exclusively between the teacher and a classroom of students.
- Quick responses are a good indicator of intelligence and learning.
- The “scientific method” is a template for how science is done and should be conducted in the classroom.
- The facts of science are the most important things for students to learn.
- When it comes to instruction, one size fits all.
- Teaching science as inquiry means providing hands-on experiences.

Course Assignments

See *General Criteria* described in the syllabus. All written work should be typed and a paper copy should be brought to class. You must make prior arrangements for submitting an assignment late. Indicate any references you have used for your assignment with a separate section entitled, "reference(s)". Make sure the reader can track the references to their source. The portion of course grade is in (parentheses).

A Professional Disposition (10%)

- 1 Participation in class is an opportunity for you to develop a professional disposition and enact it with other science and mathematics colleagues. To assess professional disposition we will use the following components. These components will be evaluated separately but will be combined to form a larger picture of your professional disposition and this portion of the grade will not be a strict total of individual evaluations. The whole picture is expected to look better than simply the sum of the parts.
 - a Reading responses assigned must be completed before class,
 - b Participation as a member of this learning community,
 - c Serving as a critical friend to colleagues in the class,
 - d Completing in-class activities and reflections.

B Reflections on Inquiry Papers (20%)

- 1 Specific short papers will be assigned throughout the term to help summarize and reflect on inquiry in science and in the science classroom.

C Microteaching (20%)

- 1 You will be asked to practice specific discourse moves in relation to student questioning and inquiry.

D Work Sample Unit Plan (10%)

- 1 While not a specific part of the course, you will be asked to submit a unit plan draft for your spring work sample for review by the end of the term and before you begin your lesson planning.

E Extended Inquiry Project (30%)

- 1 In the Extended Inquiry Project you will be asked to design a multiple-day inquiry experience for your students to be taught in Spring term. It does not need to be part of your work sample.

F Final Exam (10%)

- 1 The final exam, to be completed during finals week, will cover the course learning objectives.