



*"Not unto ourselves alone are we born"*

## Willamette University School of Education

**Course Title:** Methods and Research in Science Education

**Semester:** Fall 2009

**Instructor Names:** Ron Gray and Steve Holman

**Phone:** 503-351-7707 (Ron Gray)

**Email:** regray@willamette.edu, holman\_steve@salkeiz.k12.or.us

### **Required Textbooks or Readings**

**Books:** A textbook is not required for this course. Research articles and other readings will be provided. In addition, the candidates will use the Internet to examine research reports and the Oregon Department of Education (ODE) web site, and printed material provided by the ODE and national organizations to examine standards, methodology, and resources.

### **Course Description:**

District, unit, and daily goal development based upon research within science education. Special emphasis upon instructional materials, activities, physical space constraints, and evaluative techniques.

### **Relation to Conceptual Framework**



The Conceptual Framework for the School of Education is represented by the concepts of content knowledge, reflective learning, culture, collaboration and leadership. Using the *content knowledge* learned in the candidates undergraduate program this course will focus on the notion that *reflective teacher leaders* maintain an inquiry and *collaborative orientation* toward the educational process while *exploring and responding to the diversity of the public school classroom culture*. Course sessions provide an opportunity for intensive examination of methods and materials critical to establishing a positive learning environment and implementing effective instruction.

### **Standards and Assessments:**

#### **National Science Education Standards**

Teaching Standard A:

Teachers of science plan an inquiry-based science program for their students.

Teaching Standard B:

Teachers of science guide and facilitate learning.

Teaching Standard D:

Teachers of science design and manage learning environments that provide students with the time, space, and resources needed for learning science.

Teaching Standard E:

Teachers of science develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning.

### **INTASC Principals and indicators:**

Principle 3: The candidate understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse learners.

3.31 The candidate identifies and designs instruction using multiple strategies appropriate to the student's stage of development, learning styles, multi-intelligence, strengths, and particular learning differences and needs (skill). Critical Assessment (TSPC 1a)

Principle 4: The candidate understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

4.13 The candidate knows how to enhance learning through the use of a wide variety of materials as well as human and technological resources (knowledge). Critical Assessment (TSPC 1e, 3e)

Principle 7: The candidate plans instruction based upon knowledge of the subject matter, the students, the community at large, and the district curriculum goals.

7.31 The candidate selects and creates learning experiences that are appropriate for curriculum goals, relevant to learners, and based upon best teaching practice (skill). Critical Assessment (TSPC 1a, 1d, 3a, 3b, 3c)

### **TSPC Competencies**

Learning experiences in this class are designed to help you to meet the following competencies required by the Teacher Standards & Practices Commission (TSPC):

**1a)** Select or write learning goals for units of instruction that are consistent with the school's long-term curriculum goals. State content standards and district standards, research findings on how student learn, and the physical and mental maturity of one's students;

**1d)** Determine content, skills, and processes that will assist students in accomplishing desired unit outcomes, and design learning activities that lead to their mastery;

**1e)** Select and organize materials, equipment and technologies needed to teach a unit of instruction;

**3a)** Choose organizational structures appropriate for the objectives of instruction

**3b)** Communicate learning outcomes to be achieved and focus student interest on tasks to be accomplished;

**3c)** Implement instructional plans that employ knowledge of subject matter and basic skills

**3e)** Emphasize instructional techniques that promote critical thinking and problem solving, and that encourage divergent as well as convergent thinking.

<b>INTASC Principle/indicators</b>	<b>TSPC standard and indicators</b>	<b>Course Assignment</b>	<b>Assessment Tool</b>	<b>Critical Assessment (Y/N)</b>
3.31 The candidate identifies and designs instruction using multiple strategies appropriate to the student's stage of development, learning styles, multi-intelligence, strengths, and particular learning differences and needs (skill). Critical Assessment (TSPC 1a)	<b>1a)</b> Select or write learning goals for units of instruction that are consistent with the school's long-term curriculum goals. State content standards and district standards, research findings on how student learn, and the physical and mental maturity of one's students;	<b>Critical Assessment</b>	<b>Rubric</b>	<b>Yes</b>
4.13 The candidate knows how to enhance learning through the use of a wide variety of materials as well as human and technological resources (knowledge). Critical Assessment (TSPC 1e, 3e)	<b>1e)</b> Select and organize materials, equipment and technologies needed to teach a unit of instruction; <b>3e)</b> Emphasize instructional techniques that promote critical thinking and problem solving, and that encourage divergent as well as convergent	<b>Critical Assessment</b>	<b>Rubric</b>	<b>Yes</b>

	thinking.			
7.31 The candidate selects and creates learning experiences that are appropriate for curriculum goals, relevant to learners, and based upon best teaching practice (skill). Critical Assessment (TSPC 1a, 1d, 3a, 3b, 3c)	<p><b>1d)</b> Determine content, skills, and processes that will assist students in accomplishing desired unit outcomes, and design learning activities that lead to their mastery;</p> <p><b>3a)</b> Choose organizational structures appropriate for the objectives of instruction</p> <p><b>3b)</b> Communicate learning outcomes to be achieved and focus student interest on tasks to be accomplished;</p> <p><b>3c)</b> Implement instructional plans that employ knowledge of subject matter and basic skills</p>	<b>Critical Assessment</b>	<b>Rubric</b>	<b>Yes</b>

**Diversity:**

Candidates learn and practice strategies respectful of all students, backgrounds, and skills. Assignments build on student strengths and strategies to enable success for all students.

**Use of Technology:** Candidates will utilize internet resources for course content and for class presentations.

**Course Policies:**

- *Attendance:* You are expected to attend every mandatory class session. If for some reason you cannot attend, you must contact your instructor *before* the class session.
- *Disability Services:* Candidates with special needs or disabilities should notify the Office of Disability and Learning Services. Joanne M. Hill is the Director and her office is located in the Bishop Wellness Center. Phone number is 503 370 6471.
- *APA style:* Please use APA style when citing sources  
 \*\*If you need additional support in using APA citation formats:  
[library.willamette.edu/guides/owl.english.purdue.edu](http://library.willamette.edu/guides/owl.english.purdue.edu)

**Grading Policy:** Your grade in the class will be based on the following:

Reading Questions = 20%

Active class Participation and Attendance = 30%

Science-in-Action Report = 30%

Critical Assessment = 20%

A= 90% +

B= 80-89%

C= 70-79%

D= 69% or lower (Not passing)

### **Reading Questions**

You will be responsible for providing written answers for the weekly reading assignments. They are due at the beginning of each class and will be used in the in-class discussions.

### **Science-in-Action Report:**

Abstract ideas, such as the ones we will be discussing in this course, can often be clarified through examples. For this assignment, you will read a book-length account of the scientific enterprise (e.g. *The Double Helix: A Personal Account of the Discovery of the Structure of DNA*, or *A Feeling for the Organism: The Life and Work of Barbara McClintock*). You will compare the account to course ideas, making connections, finding examples, and discovering discrepancies. You will be asked to write a short written report and present your findings as well as to weave your observations into class discussions.

### **Scoring Rubric for Science-in-Action Report**

**80% weak passing (Needs Improvement):** Links between book's narrative and aspects of the nature of science are not clear. Focus is more on summary as opposed to analysis and connections. Written and oral presentations are not at graduate level.

**90% (Meets Standards):** Both the written and oral presentation of your findings are of good quality. Links between the book's narrative and elements of the nature of science as described in Science for All Americans and course content are evident. Bibliography is present.

**100%(Exceeds Expectations):** Both the written and oral presentation of your findings are of high quality. Aspects of the book's narrative are tied together with elements of the nature of science as described in Science for All Americans and course content. Bibliography showing extra research is given.

## RUBRIC FOR SCORING ALL ASPECTS OF THE CRITICAL ASSESSMENT ASSIGNMENT

**Name:**

INTASC/TSPC Principle/Indicator	Needs Development	Meets Expectations	Exceeds Expectations
Use multiple strategies to address the needs of all learners. Principle 3.31 TSPC 1a	Only one instructional strategy is used to address the needs of diverse learners.	Two instructional strategies are used to address the needs of diverse learners.	Three or more strategies are used to address the needs of diverse learners.
Enhance learning using a variety of materials including technological resources to support higher level thinking skills.  Principle 4.13 TSPC 1e, 3e	The materials used do not include a variety of technological resources and do not support higher level thinking skills.	2-3 different types of materials including technological resources are used to support higher level thinking skills.	4 or more different types of materials including technological resources to enhance and encourage students' development of critical thinking, problems solving, and performance skills.
Use appropriate organizational structures and instructional strategies that are appropriate for curriculum goals, the objectives of instruction and are relevant to learners.  Principle 7.31 TSPC 1a, 1d, 1e, 3a, 3b	The organizational structures used in the assignment do not support the objective of the instruction.	The organizational structures and instructional strategies used in the assignment support the objectives of the instruction and focus student interest on the objectives.	The organizational structures and instructional strategies used in the assignment are clearly aligned with the objectives of the instruction. The learning activities reflect best practice, focus student interest on the objectives, are relevant to learners and assist students in mastering the objectives of the assignment (activity, lesson, or project)
Instructional plans are based on knowledge of the subject matter, the students, community and curriculum goals.  Principle 7 TSPC 1a, 1d, 3c	The assignment shows a lack of content knowledge and/or basic skills in the subject matter and are not aligned with curriculum goals	Content knowledge and basic skills are demonstrated in the assignment and objectives are aligned with curriculum goals.	In depth content knowledge and basic skills are used to allow the students to explore the subject. The candidate demonstrates knowledge of the students and the community in designing learning opportunities.
9.31 The candidate uses classroom observation, information about students, and research as sources for evaluating the outcomes of teaching and learning as a basis for experimenting with and reflecting on revising practice (skill).	You do not apply what you have learned from this observation to your teaching practice, or your next steps do not seem connected to the data you observed.	You apply what you have learned from this observation experience to develop at least two next steps to improve your teaching practice.	You apply what you have learned from this observation experience to develop 3 or more next steps to improve your teaching practice.

**Bibliography:**

- American Association for the Advancement of Science [AAAS]. (1990). *Science for all Americans*. New York: Oxford University Press.
- American Association for the Advancement of Science [AAAS]. (1993). *Benchmarks for Science Literacy* (p. 418). New York: Oxford University Press.
- Ben-Ari, M. (2005). *Just a Theory: Exploring the Nature of Science* (p. 237). Prometheus Books.
- Driver, R., Leach, J., Millar, R., & Scott, P. (1996). *Young People's Images of Science*. Buckingham, UK: Open University Press.
- Kuhn, T. S. (1962). *The Structure of Scientific Revolutions* (p. 172). University of Chicago Press.
- Latour, B. (1988). *Science in Action: How to Follow Scientists and Engineers Through Society* (p. 287). Harvard University Press.
- National Academy of Sciences, S. (1998). *Teaching About Evolution and the Nature of Science*. Washington, D.C.: National Academy Press.
- National Research Council [NRC]. (1996). *National Science Education Standards*. Washington, D.C.: National Academic Press.
- National Research Council [NRC]. (2000). *Inquiry and the National Science Education Standards: A Guide for Teaching and Learning* (S. Olson & S. Loucks-Horsley, Eds.). National Academy Press.