

# SED 413/513 – Nature of Science and Science Education

Instructor Ron Gray

Phone 503-351-7707

Office Weniger 241

E-mail grayron@onid.orst.edu

Meeting Times Tuesday and Thursday @ 8:00-9:20am in Weniger 247



*Over the course of human history, people have developed many interconnected and validated ideas about the physical, biological, psychological, and social worlds. Those ideas have enabled successive generations to achieve an increasingly comprehensive and reliable understanding of the human species and its environment. The means used to develop these ideas are particular ways of observing, thinking, experimenting, and validating. These ways represent a fundamental aspect of the nature of science and reflect how science tends to differ from other modes of knowing.*

*Science for All Americans, p. 1*

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## Required Texts:

National Academy of Sciences (U.S.). (1998). *Teaching About Evolution and the Nature of Science*. Washington, DC: National Academy Press.

Fenstermacher, G.D. (2004). *Approaches to Teaching*. New York: Teachers College Press.

## Course Description:

In 1990, the American Association for the Advancement of Science, in *Science for All Americans*, broadly defined science literacy to include understanding some of the key concepts and principles of science, having a capacity for scientific ways of thinking, and being familiar with the nature of science. The National Science Education Standards (NSES) (1996) reinforced this view of science literacy by defining what teachers of science should know. According to the NSES, "*All teachers of science must have a strong, broad base of scientific knowledge extensive enough for them to understand the nature of scientific inquiry, its central role in science, and how to use the skills and processes of scientific inquiry. (p. 59)*"

Accordingly, science teachers need to understand the nature of science in order to improve the scientific literacy of their students. Therefore, it behooves science educators to begin to examine issues related to the nature of science, such as: What is science? How is scientific knowledge produced? What is the role of the scientific community in knowledge production and justification? In this course, we will begin to explore these questions and their impact on teaching science. We will also focus on practical applications of these concepts in the classroom.

The second section of this course concerns an introduction to different approaches to teaching. We will focus on the connections between theories of teaching and the practice of teaching. In particular, we will examine the Executive, Facilitator, and Liberationist approaches.

Statement Regarding Students with Disabilities:

Course adheres to all OSU Academic Regulations as found in the Schedule of Classes. Students with documented disabilities who may need accommodations, who have any emergency medical information the instructor should know of, or who need special arrangements in the event of evacuation, should make an appointment with the instructor as early as possible, no later than the first week of the term.

Goals:

By the end of the course, I expect that you will:

- Understand various philosophical positions with regard to the nature of science
- Have considered the roles of the scientific society, culture, and history in creating science knowledge
- Have clarified and refined your own views of the nature of science
- Be aware of commonly held ideas about the nature of science among the general public and K-12 students
- Identify implications of perspectives of the nature of science for instruction at the K-12 level
- Understand the strengths and weaknesses of different teaching approaches on learning

Requirements:

Requirements for the course include:

- **Attendance.** Much of the course is run in-class (discussions, activities, etc.). Contact the instructor for planned absences.
- **Participation.** It is important for everyone in the course to be actively involved in discussions and activities as well as to make significant contributions to the course.
- **Assignments.** All assignments must be turned in on or before their due date. For every day an assignment is late it will be lowered one full letter grade.
- **Readings.** The readings have been chosen to highlight the course topics. Without the readings, you will not be able to intelligently participate in the discussions.
- **Integrity.** You are responsible for making yourself aware of OSU Academic Regulations.

Resources:

- Science for All Americans  
(<http://www.project2061.org/publications/sfaa/online/sfaatoc.htm>)
- Benchmarks for Science Literacy  
(<http://www.project2061.org/publications/bsl/online/bolintro.htm>)
- National Science Education Standards (<http://www.nap.edu/readingroom/books/nses/>)

Evaluation:

The grading system consists of 12 grades (A, A-, B+, B, B-, C+, C, C-, D+, D, D-, and F). You will be evaluated in the following way:

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|------------------------------------|-----|
| • Participation and Attendance     | 15% |
| • Personal Statements              | 25% |
| • Book Report                      | 25% |
| • In-Class and Reading Assignments | 35% |

## Course Schedule

Week	Topic	Required Readings	
1	January 8 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Pre-assessment</li> <li>• Nature of Science Discussion</li> </ul>	<ul style="list-style-type: none"> <li>• Perkins-Gough (2007)</li> </ul>
	January 10 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Class Introduction</li> <li>• Introduce book report</li> </ul>	<ul style="list-style-type: none"> <li>• Driver (1996) Ch. 3 (24-41)</li> </ul>
2		<ul style="list-style-type: none"> <li>• Philosophy of Science</li> </ul>	<ul style="list-style-type: none"> <li>• Science for All Americans Ch. 1</li> <li>• Teaching About Evolution and the Nature of Science Ch. 1 (p.4-6) and Ch. 3</li> </ul>
	January 15 <sup>th</sup>		<ul style="list-style-type: none"> <li>• Hagen (1996) Ch. 3</li> </ul>
3	January 17 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Philosophy of Science</li> <li>• Nature of Science tenets</li> </ul>	
	January 22 <sup>rd</sup>	<ul style="list-style-type: none"> <li>• Nature of Science in Science Education</li> <li>• Definition of Terms</li> </ul>	<ul style="list-style-type: none"> <li>• Ben-Ari (2005) Ch. 3</li> </ul>
4	January 24 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Teaching the Nature of Science</li> </ul>	<ul style="list-style-type: none"> <li>• Schwartz (2007)</li> </ul>
	January 29 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Teaching the Nature of Science</li> <li>• <b>Personal Nature of Science Statement Due</b></li> </ul>	
5	January 31 <sup>st</sup>	<ul style="list-style-type: none"> <li>• Teaching the Nature of Science</li> </ul>	
	February 5 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Teaching the Nature of Science</li> </ul>	
6	February 7 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Teaching the Nature of Science</li> </ul>	<ul style="list-style-type: none"> <li>• Sagan "The Fine Art of Baloney Detection"</li> <li>• Ben-Ari "Pseudoscience"</li> </ul>
	February 12 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Pseudoscience</li> </ul>	<ul style="list-style-type: none"> <li>• deGrasse Tyson (2005)</li> </ul>
7	February 14 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Evolution Case Study</li> </ul>	<ul style="list-style-type: none"> <li>• Farber (2003)</li> <li>• The Evolution Wars</li> </ul>
	February 19 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Evolution Case Study</li> </ul>	<ul style="list-style-type: none"> <li>• Teaching Evolution and the Nature of Science Ch. 5</li> <li>• Prothero or Weiner</li> </ul>
8	February 21 <sup>nd</sup>	<ul style="list-style-type: none"> <li>• Evolution Case Study</li> </ul>	
	February 26 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Post-assessment</li> <li>• <b>Book Report due</b></li> <li>• Peer Review</li> </ul>	<ul style="list-style-type: none"> <li>• Approaches to Teaching Chapter 1 &amp; pp.78-80</li> </ul>
9	February 28 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Approaches to Teaching</li> </ul>	<ul style="list-style-type: none"> <li>• Group chapter</li> </ul>
	March 4 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Approaches to Teaching</li> </ul>	
10	March 6 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Group presentations</li> </ul>	
	March 11 <sup>th</sup>	<ul style="list-style-type: none"> <li>• Case studies</li> </ul>	
	March 13 <sup>th</sup>	<ul style="list-style-type: none"> <li>• <b>Personal Teaching Strategy Statement Due</b></li> <li>• Case studies</li> </ul>	