

* **Subject & Course:** SED 513 Science Materials and Methods: Nature of Science

* **Credits:** 3

* **Instructor's name:** Ron Gray

* **Instructor's email and/or phone:** grayron@onid.orst.edu/503-351-7707

◆ **Link to instructor's on-line bio/website:** <http://www.oregonstate.edu/~grayron/>

* **OSU catalog course description, including pre-requisites/co-requisites:** Development of instructional materials, laboratories, and demonstrations in science for the elementary, middle, and high schools using modern learning theory as the basis.

* **Course content:**

Course goals

Upon completion of this course, you will-

- Understand various philosophical and sociological positions on the nature of science.
- Have clarified and refined your own views of the nature of science.
- Develop instructional materials, laboratories, or demonstrations in science to teach the nature of science at elementary, middle, or high schools.

◆ **Blackboard** — This course will be delivered via Blackboard (<http://my.oregonstate.edu>), your online learning community, where you will interact with your classmates and with me. Within the course Blackboard site you will access the learning materials, tutorials, and syllabus; discuss issues; submit assignments; email other students and the instructor; participate in online activities; and display your projects. To preview how an online course works, visit the [Ecampus Course Demo](#). For technical assistance, Blackboard and otherwise, see <http://ecampus.oregonstate.edu/services/technical-help.htm>.

Course Schedule

You will be responsible to finish reading and write up reading response journals on the following schedule.

Week	Topic	Reading	Assignments Due*
Week 1 9/29 – 10/3	Introduction What is Science?		Pre-assessment
Week 2 10/6 – 10/10	Nature of Science in Science Education	SFAM Ch. 1	NOS Summaries
Week 3 10/13 – 10/17	How Scientists Know	Ben-Ari Ch. 1 & 2	Reading Journal
Week 4 10/20 – 10/24	Growth of Scientific Knowledge	Ben-Ari Ch. 4 & 6 SFAM Ch. 10	
Week 5 10/27 – 10/31	Scientific Terminology	Ben-Ari Ch. 3 Schwartz (2007)	Reading Journal
Week 6 11/3 – 11/7	The Limits of Science	Ben-Ari Ch. 5 Sagan Reading	Textbook Review
Week 7 11/10 – 11/14	Sociological Issues in Science	Ben-Ari Ch. 6 & 8	Reading Journal

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Week 8 11/17 – 11/21	Teaching the Nature of Science	TAENS Ch. 3 & 6 Internet Resources	
Week 9 11/24 – 11/28	Teaching About Evolution	TAENS CH. 1 & 4 Farber (2003)	Reading Journal
Week 10 12/1 – 12/5	Approaches to Teaching	ATT Ch. 1-6	
Week 11 12/8 – 12/12	Implications for Science Education		NOS Lesson Plans** Post-Assessment

*All assignments are due the following Monday at 8am.

**Assignments due finals week are due on Friday, 12/12 at 5:00pm.

*** Measurable student learning outcomes:**

Your accomplishment of the course goals will be demonstrated by the following course products:

1. Discussion and participation on the online discussion board
2. Reading response journals
3. Textbook analysis
4. Science lesson plans for teaching the nature of science

*** Learning resources:**

NOTE to prospective students: Please check with the OSU Bookstore for up-to-date DVD, course packet, and textbook information for the term you enroll (<http://www.osubookstore.com/> or 800-595-0357). If you purchase course materials from other sources, be very careful to obtain the correct ISBN.

Required books:

1. National Academy of Sciences (U.S.). (1998). *Teaching About Evolution and the Nature of Science*. Washington, DC: National Academy Press.
2. Fenstermacher, G.D. (2004). *Approaches to Teaching*. New York: Teachers College Press.
3. Ben-Ari, M. (2005). *Just a Theory: Exploring the Nature of Science*. Amherst: Prometheus Books.

Required readings:

American Association for the Advancement of Science. (1989). *Science for all Americans*. New York: Oxford University Press. Available online:
<http://www.project2061.org/publications/sfaa/online/sfaatoc.htm>

Optional books:

- American Association for the Advancement of Science [AAAS]. (1990). *Science for all Americans*. New York: Oxford University Press.
- Bell, R.L. (2008). *Teaching the Nature of Science through Process Skills: Activities for Grades 3-8*. Boston: Pearson Press.

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* **Evaluation of student performance:** Evaluation of performance includes formative, on-going assessment of course activity participation and project reports. Descriptions of course activities and projects are the following:

1. Discussion Participation (25%): You are expected to participate in group discussion as well as whole class discussion through discussion board. Thoughtful and critical participation in discussion will be appreciated by the members of the class and evaluated. You are required to log on **at least two times a week** and participate in discussion. Both quality and quantity will be evaluated. In order to assist productive discussion, you will take one of the following roles in your group. Each week you need to take a different role.

1. **Proposer and organizer:** Read ahead of time and propose reading and discussion questions in the beginning of the week when the reading was assigned. Keep discussion threads, questions, and topics connected into lines of thought.
2. **Extender:** Move the discussion into interesting areas beyond this course.
3. **Wrapper:** Wrap up the weekly discussion by posting a synthesis by **Monday** morning.

Evaluation Criteria: Productive and thoughtful fulfillments of roles taken based on the instructor's review of discussion board as well as peer evaluation at the end of the term.

2. Reading Response Journal (25%). While you read, think, and discuss, it is also important that you write. Writing is integral to the thinking process; it helps you to construct and clarify your thoughts besides providing a record of progress and a memory aid. You are asked to type reactions to readings and develop discussion questions. Please start each entry with the date and readings to which you are responding to in **BOLD** (e.g., **Sept. 20: Ben-Ari, Chapters 1-2**). Submit entries by **Monday morning** of each odd-numbered week. **No late submission is accepted for this assignment.** There is **no limit on length**, but your ideas and thoughts need to be effectively communicated in writing. Also, you should clearly demonstrate that you have put time and efforts into reading and discussion in your journal.

Evaluation Criteria: Evidence of thorough understanding of and critical discussion of the material as well as the generation of proper questions.

3. Textbook Review and Analysis (20%). Abstract ideas, such as the ones we will be discussing in this course, can often be clarified through applications. For this assignment choose a major concept of your teaching area (e.g., electricity, cell, rocks and minerals, solar system). Review the relevant chapters of a science textbook that you do (or would) use that deal with the concept/topic and analyze them to determine how they illuminate the nature of science explicitly and/or implicitly. Write a written report (**800-1000 words**) of your findings while weaving your observations into course discussions. You are expected to utilize course ideas, find examples, and discover discrepancies.

Evaluation Criteria: Evidence of proper application of course content to analysis and critical analysis of textbook

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4. Planning and Teaching the Nature of Science (Lesson Plan) (30%). With your understanding of various philosophical and sociological positions on the nature of science, you are expected to apply your learning to instruction by developing instructional materials for your students. This assignment can also assess your thinking at the level of application and synthesis. While you are reading for the course, you will be frequently asked to think about how your reading is related to science teaching and to generate relevant pedagogical questions, goals, ideas, and methods throughout the course as well as develop specific lesson plans. Example pedagogical questions are the following:

How can I use the case of Galileo in teaching about gravity to help students understand the way scientists prove or generate a law? How can I help students become aware of gender influences in science? What topics in science can I use to teach the uncertain nature of science? How?

Plan at least five 40-50 minute lesson plans (in a narrative that describes student grade/age, lesson objectives (which aspects of nature of science), assessment method, and lesson activities) you can implement in the near future. Specific list of lesson plan components will be discussed during the course.

Evaluation Criteria: Complete, creative, thoughtful, and pedagogically sound (considering student capabilities and prior knowledge; plausible in school settings) plans, evidence of proper application of course content

◆ **Course Policies:**

◆ **Incompletes** — Take this course only if you plan to finish it in a timely manner (during this term). I assign an "I" or incomplete only when there is a strong and compelling case for doing so (e.g., health reasons, military commitment). I will not consider assigning an incomplete unless the individual has completed over 50% of the course activities (5 or more weeks of participation in discussion, reading journals, and textbook analysis). Please note that students receiving incompletes are subject to assignment weight reduction (and consequently may not be eligible for A or A- grades) because some of their work will be submitted late.

* **Statement Regarding Students with Disabilities:**

Accommodations are collaborative efforts between students, faculty and [Services for Students with Disabilities \(SSD\)](#). Students with accommodations approved through SSD 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 SSD should contact SSD immediately at 541-737-4098.

* **Expectations for Student Conduct:**

Student conduct is governed by the university's policies, as explained in the [Office of Student Conduct: information and regulations](#).

In an academic community, students and faculty, and staff each have responsibility for maintaining an appropriate learning environment, whether online or in the classroom.

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Students, faculty, and staff have the responsibility to treat each other with understanding, dignity and respect. Disruption of teaching, administration, research, and other institutional activities is prohibited by Oregon Administrative Rule 576-015-0015 (1) and (2) and is subject to sanctions under university policies, OSU Office of Student Conduct.

♣ **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.

♣ **Conduct in this online classroom** — Students are expected to conduct themselves in the course (e.g., on discussion boards, email postings) in compliance with the university's regulations regarding civility. Students will be expected to treat all others with the same respect as they would want afforded themselves. Disrespectful behavior to others (such as harassing behavior, personal insults, inappropriate language) or disruptive behaviors in the course (such as persistent and unreasonable demands for time and attention both in and out of the classroom) is unacceptable and can result in sanctions as defined by Oregon Administrative Rules Division 015 Student Conduct Regulations.

♣ **Communications:**

♣ **Ground Rules for Online Communication & Participation:**

- *Online threaded discussions* are public messages, and all writings in this area will be viewable by the entire class or assigned group members. If you prefer that only the instructor sees your communication, send it to me by email, and be sure to identify yourself and the class.
- Posting of personal contact information is discouraged (e.g. telephone numbers, address, personal website address).
- *Online Instructor Response Policy:* I will check email frequently and will respond to course-related questions within 24 hours.
- *Observation of "Netiquette":* All your online communications need to be composed with fairness, honesty and tact. Spelling and grammar are very important in an online course. What you put into an online course reflects on your level of professionalism. Here are a couple of references that discuss
 - writing online: <http://goto.intwg.com/>
 - netiquette: <http://www.albion.com/netiquette/corerules.html>.
- Please check the Announcements area and the course syllabus before you ask general course "housekeeping" questions (i.e. how do I submit assignment 3?). If you don't see your answer there, then please contact me.

♣ **Guidelines for a productive and effective online classroom**

- The discussion board is your space to interact with your colleagues related to current topics or responses to your colleague's statements. It is expected that each student will participate in a mature and respectful fashion.

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- Participate actively in the discussions, having completed the readings and thought about the issues.
- Pay close attention to what your classmates write in their online comments. Ask clarifying questions, when appropriate. These questions are meant to probe and shed new light, not to minimize or devalue comments.
- Think through and reread your comments before you post them.
- Assume the best of others in the class and expect the best from them.
- Value the diversity of the class. Recognize and value the experiences, abilities, and knowledge each person brings to class.
- Disagree with ideas, but do not make personal attacks. Do not demean or embarrass others. Do not make sexist, racist, homophobic, or victim-blaming comments at all.
- Be open to be challenged or confronted on your ideas or prejudices.

◆ Student Assistance:

◆ **Contacting the instructor** — E-mail the instructor with questions regarding course content.

◆ **Technical Assistance** — If you experience computer difficulties, need help downloading a browser or plug-in, assistance logging into the course, or if you experience any errors or problems while in your online course, contact the OSU Help Desk for assistance. You can call (541) 737-3474, email osuhelpdesk@oregonstate.edu or visit the [OSU Computer Helpdesk](#) online.

♣ Tutoring —

- **Writing:** OSU offers a range of resources to assist you in becoming a better academic writer. Specifically, you are encouraged utilize the [OSU Online Writing Lab](#) and/or the online tutoring service available free through [Smarthinking](#); both of these services are valuable resources to improve your writing and adherence to APA style.
- **Other Tutoring:** Online tutoring is available free to Ecampus students, as described in the [tutoring](#) section of the Ecampus website.

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