"What greater or better gift can we offer the Republic than to teach and instruct our youth?"
Cicero

George Mason University
College of Education and Human Development
Secondary Education Program

EDCI 473:001 Teaching Science in the Secondary School
Spring Semester, 2012

Instructor:	Dr. Stephen Burton
Date and Time:	(January 24 – May 8) Tuesdays 7:20-10 pm
Class Location:	Thompson 2020
Telephone:	616-502-2175
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Office Hours:	By appointment

Text Resources

- Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities and instructional resources (Grades 6-12).* San Francisco: Jossey-Bass.

Online Resources

- National Research Council (1996). *National science education standards*. Washington, DC: National Academy Press. Available online at http://www.nap.edu/openbook.php?record_id=4962

- Commonwealth of Virginia (2010). *Standards of Learning for Virginia Public Schools.* Richmond, Virginia. Retrieved on August 14, 2011 from http://www.doe.virginia.gov/testing/index.shtml

- Commonwealth of Virginia (2003). *Science Standards of Curriculum Framework Guides.* Retrieved on August 14, 2007 from http://www.pen.k12.va.us/VDOE/Instruction/sol.html#science.

- National Science Teachers' Association. *Science Class* newsletter. Retrieved on August 14, 2007 from http://www.nsta.org/publications/enewsletters.aspx.

- American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*. Retrieved on August 14, 2007 from http://www.project2061.org/tools/benchol/bolframe.htm.

- McComas, W. F. (1998). *The principle elements of the nature of science: Dispelling the myths.* Retrieved on August 14, 2007 from http://coehp.uark.edu/pase/TheMythsOfScience.pdf.

- Peters, E. E. (2006). *Why is teaching the nature of science so important?* Retrieved on August 14, 2007 from http://www.vast.org/content/File/v1n1/linkedwhole.pdf.

- American Chemical Society (2007). *Educators & Students page.* Retrieved on August 14, 2007 from http://www.chemistry.org/portal/a/c/s/1/educatorsandstudents.html.

- American Chemical Society (2003). *Safety in Academic Chemistry Laboratories Accident Prevention for Faculty and Administrators*. (800 227-5558) Free single copies or online: http://membership.acs.org/c/ccs/pubs/sacl_faculty.pdf

- U.S. Government Printing Office (2007). *Code of Federal Regulations.* Retrieved on August 14, 2007 from http://www.gpoaccess.gov/cfr/index.html.

- U.S. Department of Labor (2007). *Occupational Health and Safety Administration.* Retrieved on August 14, 2007 from http://www.osha.gov/.

- American National Standards Institute (2007). *American National Standards Institute Homepage.* Retrieved on August 14, 2007 from http://www.ansi.org/.

- Maryland Public Schools (2007). *Legal Aspects of Laboratory Safety.* Retrieved on August 14, 2007 from http://mdk12.org/instruction/curriculum/science/safety/legal.html.

Other articles/handouts will be distributed in class or posted on-line at the course website. (Your GMU email address is required for communication with the course instructor and for using Blackboard!)

Course Materials Online

The Blackboard site can be found at http://mymasonportal.gmu.edu. Use the same login as your GMU email. Materials will be added throughout the semester based upon needs from the course.

Course Description

EDCI 573 is the first course in a two-part sequence of science methods courses for pre-service and provisionally licensed science teachers. The course is designed to build fundamental knowledge of science teaching and learning including standards-based curriculum design and research-based teaching strategies. The course focuses on developing inquiry-based lessons for students to investigate science and assessing student understanding of science and the nature of science. The teachers will plan lessons for students to learn science, implement lessons in a high school classroom, observe students learning, and evaluate their teaching and student outcomes. Field experience is a required part of this course.

Goals

The pre-service and provisionally licensed teacher will:

- Build a repertoire of science teaching and assessment strategies by reading, writing, observing, participating in, and reflecting on the teaching and learning of science; RESEARCH-BASED PRACTICE; SPA STANDARDS 1, 3, 5, 6, 8, 10
- Develop strategies to help students become scientifically literate, think critically and creatively, understand the nature of science, and see the importance of science as a way of knowing; ETHICAL LEADERSHIP; INNOVATION; SPA STANDARDS 2, 3, 4
- Plan standards-based (local, state, and national) units of science study including daily lesson plans for students that reflect research in effective science teaching and learning; RESEARCH-BASED PRACTICE; SPA STANDARD 5, 6, 8, 10
- Construct science lessons that include alignment of objectives, activities, and assessments that address the needs of a variety of student populations including English language learner, special needs students, and gifted and talented students; ETHICAL LEADERSHIP; SPA STANDARDS 8, 10
- Learn about science laboratory safety and plan teaching activities that highlight safety; ETHICAL LEADERSHIP; SPA STANDARD 9
- Work collaboratively with peers to teach and discuss science and science teaching. COLLABORATION; SPA STANDARD 10
- Incorporate environmental sustainability into teaching paradigms and into daily life. SOCIAL JUSTICE; SPA STANDARD 4

Relationship to Program Goals and Professional Organizations

EDCI 473 is the first course in a two-course sequence of science methods courses for students seeking a secondary school teaching license in earth science, biology, chemistry, or physics. The course builds on students' knowledge of their subject matter. The course focuses on the teaching of science as called for by the state and national science standards and as outlined by the National Council for Accreditation of Teacher Education (NCATE), the National Science Teachers Association (NSTA), and the Interstate New Teacher Assessment and Support Consortium (INTASC). EDCI 473 builds a repertoire of science teaching and assessment strategies to facilitate student learning.

Nature of Course Delivery

A variety of teaching strategies will be used to explore the themes of the day. All students will continuously analyze and evaluate teaching strategies, as well as science content, processes, and ways of knowing in science.

Sustainability at GMU

George Mason University is focusing on making our community "greener" and reducing the impact on the environment. This course will contribute to this effort in the following ways. I hope that you will create other ways to contribute to contribute to this effort.

- Handouts will be available electronically through the Blackboard platform
- All assignments will be submitted through the blackboard on a Wiki site established fir each individual student.
- You should consider reducing waste in your teaching practice (ex: unnecessary paper) and in developing your unit plan
- Incorporate teaching sustainability in the content of your lesson plans (for example, human's role in reducing their impact on the environment.) Think about what the next generation needs to know about "greening".

College Expectations and University honor Code

The College Education and Human Development (GSE) expects that all students abide by the following: Students are expected to exhibit professional behavior and dispositions. See gse.gmu.edu for a listing of these dispositions. Students must follow the guidelines of the University Honor Code. See http://academicintegrity.gmu.edu/honorcode/ for the full honor code. Students must agree to abide by the university policy for Responsible Use of Computing. See http://universitypolicy.gmu.edu/1301gen.html for the full policy.
Students with disabilities who seek accommodations in a course must be registered with the GMU Disability Resource Center (DRC) and inform the instructor, in writing, at the beginning of the semester. See www.gmu.edu/student/drc or call 703-993-2474 to access the DRC.

Field Experience Signup

The State of Virginia requires a number of hours of field work before you can do your internship. You will acquire 30 of those hours during this class. The university will place you in the field.

The website to sign up is **http://cehd.gmu.edu/endorse/ferf.**

Learning Objectives:	Assessment:
A student will be able to consistently write measureable objectives	**Lesson Plan 3**
A student will be able to develop assessments aligned with measureable objectives	**Lesson Plan 3**
A student will be able to design a lesson in which students are actively engaged and follow a student-centered theory	**Lesson Plan 3**
A student will be able to use assessment data to evaluate student achievement of objectives	**Lesson Plan 3**
A student will be able to design a lesson in which students will learn characteristics of the nature of science	**Lesson Plan 3**
A student will be able to examine student achievement of objectives to evaluate and modify their lessons	**Microteaching Reflection Paper**
A student will be able to describe the safety issues and solutions for lessons	**Lesson Plan 3, Safety Assignment**
A student will be able to organize curriculum topics to build integrated student knowledge	**Planning Project**
A student will be able to explain the characteristics of the nature of science in context of actual science.	**Nature of Science Assignment**
A student will be able to be reflective about their own teaching and the teaching of others based upon evidence.	**Reflection Questions, Microteaching Reflection Paper, Field Experience Paper**

Grading

High quality work and participation is expected on all assignments and in class. **Attendance at all classes for the entire class is a course expectation. For each unexcused absence, the course grade will be reduced by 5% points.** All assignments are graded. Each graded assignment will be assessed using a scoring rubric which will be handed out before the assignment is due. All assignments are due at the beginning of class on the day they are due. Graded assignments that are late will automatically receive a ten percent grade reduction (one full letter grade lower).

Assessments	Points	Due Date
Nature of Science Assignment	7	February 7, 2012
Planning Project – Concept Map	5	February 14, 2012
Lesson Plan 1	5	February 21, 2012
Lesson Plan 2	5	March 20, 2012
Safety Assignment	8	April 3, 2012
Planning Project – Calendar	5	April 10, 2012
Field Experience Report	15	May 1, 2012
Lesson Plan 3	20	May 8, 2012
Microteaching Paper	20	May 8, 2012
Reflection Questions	5	
Professionalism	5	

Policy on Incompletes

If circumstances warrant, a written request for an incomplete must be provided to the instructor for approval prior to the course final examination date. Requests are accepted at the instructor's discretion, provided your reasons are justified and that a *major* percentage of your work has already been completed. Your written request should be regarded as a contract between you and the instructor and must specify the date for completion of work. This date must be at least two weeks prior to the university deadline for changing incompletes to letter grades.

Grading Scale

A = 93-100 pts
A- = 90-9 pts
B+ = 88-89 pts
B = 80-87 pts
C = 70-79 pts
F = Below 70 pts

Assignments

Science education research shows that frequent assessment of small amounts of material is most effective for learning science. Therefore, in this class formal and informal assessment will be continuously provided on assignments and class activities. Assessment is used as a tool for information that informs both learning and teaching, so this two-way communication loop is necessary for optimal learning.

Please submit assignments electronically through the Blackboard site. All written assignments are to be word-processed. Please use standard 12 point font (don't use "Chiller" or other poster font) and make your margins 1" on each side. All assignments should be double spaced and in APA format (check apa.org for more details). Make each project something that you will actually use in teaching.

You will find all assignments except the next two described in detail with instructions and when appropriate, rubrics, on the blackboard site under the assignments.

Professionalism

Learning depends on the active engagement of the participant and frequent checking by the instructor as to the progress of the learner. Smaller assignments will be given as necessary in class in order to inform your learning and my teaching. Your participation in these assignments is essential to valuable class discussions and will help to "chunk" the large assignments into smaller, more attainable learning goal. Your classmates depend on your comments to extend their learning. Attendance for each class is necessary – please contact the professor BEFORE any absence.

Other Resources

Barnekow, D. J. (1998). *Graphic organizers for science.* Portland, ME: J. Weston Walsh.

Bybee, R.W., Powell, J.C., & Trowbridge, L.W. (2008). *Teaching secondary school science: Strategies for developing scientific literacy.* Upper Saddle River, NJ: Pearson.

Cothron, J. H., Giese, R. N., Rezba, R. J. (2005). *Students and Research*. Dubuque, Iowa: Kendall/Hunt.

Hassard, J. (2005). *The art of teaching science: Inquiry and innovation in middle school and high school.* New York: Oxford University Press.

Johnson, D. W. & Johnson R. T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning.* Boston: Allyn and Bacon.

Kagan, S. (1994). *Cooperative Learning.* San Clemente, CA: Resources for Teachers, Inc.

Keely, P., Eberle, F., & Farrin, L. (2005). *Uncovering student ideas in science: 25 formative assessment probes.* Arlington, VA: National Science Teacher Association Press.

Llewellyn, D. (2002). *Inquire within: Implementing inquiry-based science standards.* Thousand Oaks, CA: Corwin Press.

McComas 2008. Proposal for core nature of science content in popular books on the history and philosophy of science: lessons for science education. In Lee, Y.J. & Tan, A.L. (Eds.) *Science education at the nexus of theory and practice.* Rotterdam: Sense Publishers.

National Resource Council. (2005). *How Students Learn: Science in the Classroom.* Committee on *How People Learn,* A Targeted Report for Teachers, M.S. Donovan and J.D. Bransford, Editors. Division of Behavioral and Social Science and Education. Washington, DC: The National Academies Press.

Slavin, R. E. (1995). *Cooperative learning.* Boston: Allyn and Bacon.

Tomlinson, C. A. (1999). *The differentiated classroom: Responding to the needs of all learners.* Alexandria, VA: Association for Supervision and Curriculum Development.

Wiggins, G. & McTighe, J. (1998). *Understanding by design.* Alexandria, VA: Association for Supervision and Curriculum Development.