SCED 301 – Interdisciplinary Science Inquiry

Fall 2006

General Information

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Meeting Time: M,W, F 1:00-2:50pm
Office Hours: M, W, F 11-12pm

Course Description

This 5-credit course is part of the middle level math/science minor or for elementary education majors who desire a science education minor, to be taken by students already admitted to the education program. Students will use concepts from biology, chemistry, earth science and physics to actively investigate the world and learn specific science processes.

Prerequisites

One lower division science course with lab from three of the following five areas: biology, chemistry, earth science, physics and astronomy.

Course Rationale

This course is designed to give students the experience necessary to become effective teachers of science in K-12 public schools. The course follows the University motto "By Teaching, We Learn" through teaching and learning experiences in class and in the community. It is consistent with the Center for Teaching and Learning theme "*facilitators of learning in a diverse world*" because students help to increase public knowledge of science. Students in this course construct their own knowledge of science methods and concepts by interacting with each other, the instructor, and community stakeholders. This course meets the goals of the CWU Science Education Program. Course science content is based on the Washington State Essential Academic Learning Requirements and Grade Level Expectations in Science (WA EALRs) and the National Science Education Standards.

Course Materials

Required: 1) Blackboard account with enrollment in SCED301.01_F06, 2) a LiveText account, 3) access to WA State Essential Academic Learning Requirements and Grade Level Expectations for Science (access OSPI at http://www.k12.wa.us/CurriculumInstruct/default.aspx), and 4) access to National Science Education Standards for Teachers and Students at http://www.nap.edu/readingroom/books/nses/.

Course Management and Assessment: Blackboard and LiveText

This course uses Blackboard (http://courses.cwu.edu) and LiveText (http://college.livetext.com) online learning tools. The Blackboard Learning System makes the course syllabus, lecture notes, assignments and important announcements available 24 hours a day, 7 days a week. It is *your responsibility* to check Blackboard *daily* so that you are aware of course changes. Before using Blackboard you have to activate your Netware account (if you haven't already) and enroll in the Interdisciplinary Science Inquiry course designated by course ID: SCED301.01_F06. To enroll in the SCED301 online course, go to http://www.cwu.edu/~media/cwuonline/getstarted.html and follow the instructions *exactly*.

LiveText will be used to assess your course projects including research proposals, research reports, and other assessments. If you do not already have a LiveText account you will need to purchase one from the Bookstore.

Objectives

The objectives of this course are based on the National Science Education Standards for teachers of science (see http://www.nap.edu/readingroom/books/nses/). This course will give you opportunity to develop skills that address these standards.

- Standard A: Teachers of science plan an inquiry-based program for their students.
- Standard B: Teachers of science guide and facilitate learning.
- Standard C: Teachers of science engage in ongoing assessment of their teaching and of student learning.
- Standard D: Teachers of science design and manage learning environments that provide students with the time, space, and resources needed for learning science.
- Standard E: Teachers of science develop communities of learners that reflect the intellectual rigors of scientific inquiry and the attitudes and social values conducive to science learning.
- Standard F: Teachers of science actively participate in the ongoing planning and development of the school science program.

Specific Learning Outcomes and Assessment

Outcomes	Assessments
1. Design and implement experiments using appropriate science processes.	Mini-Investigations, Research Project, Research Presentation
2. Use computers and related technologies to gather and analyze data.	Mini-Investigations, Research Project, In-class Exercises, Performance Assessment
3. Analyze, interpret, and present data using a variety of tools including graphs, tables, and charts.	Mini-Investigations, Research Project, Research Presentation, Written Exams, In-class Exercises, Field Trips
4. Integrate course concepts with investigative processes.	Written Exams, Mini-Investigations
5. Work in small groups to solve authentic science problems.	In-class Exercises, Research Project, Research Presentation, Field Trips
6. Form opinions based on scientific evidence and defend these positions using written and oral methods	In-class Discussions, Written Exams, Research Presentation
7. Create and present interdisciplinary science research to community stakeholders.	Research Presentations

Course Expectations and Policies

This course is not about *me* teaching *you* – it is about you making the deliberate and conscious decision to learn to be the most effective science teacher possible. My role is to help facilitate your development as a teaching professional, which I will do to the utmost of my abilities. I am open to your suggestions about how the course could be changed or made better. My aim is to have an open, professional dialogue between us; if you have suggestions, specific problems, concerns or questions please discuss these with me as they arise during the quarter. I would prefer to deal with issues as they come up rather than when it is too late to do anything to fix them.

In order to best facilitate your learning, my expectations are as follows:

- Think critically. This course is designed to help you develop your critical thinking abilities; these life skills will help you to be an effective teacher of science because students who

see you analyze, infer, evaluate, and make reasoned judgments will emulate the behaviors you model and become better learners. Developing your critical thinking skills is one of the most important things you can accomplish as a student.

- Change your expectations. This course will take a lot of work from you and from me. If you have low learning expectations for this course, that is what you will achieve. Success in this course will require open-mindedness and effort (several hours of study time for each hour of class). Depending on your science background, you may need to spend more or less time studying. Please budget your time to accommodate the workload. By working together, we can accomplish significant and meaningful learning.
- Create your own knowledge. One of the reasons that science is fun and exciting is because the answers to many scientific questions are unknown. Conducting quality experiments requires an ability to take an unstructured scenario and define and create structure so the effects of variables can be tested. This process requires applied critical thinking skills, which helps us become lifelong learners.
- Be flexible. Interdisciplinary knowledge is fluid because it exists in the gaps between our disciplinary knowledge. As we investigate scientific phenomena, we will construct interdisciplinary knowledge (less known) from disciplinary knowledge (more known). It is possible that you will experience some discomfort with the relative lack of structure that exists at the forefront of knowledge. Be flexible as we will work together to create and structure this new knowledge and investigate interdisciplinary phenomena.
- Act professionally. This course is part of your transition from student to professional educator. As such, I expect you to attend class, be on time, and help others. I will not accept late work unless you have documented reasons for your absence.
- Use common sense. Don't cheat on assignments or exams. Don't plagiarize others' work (you'll get a zero and will face disciplinary action by the university). Don't expect credit if you turn assignments in late. If you have a problem that prohibits you from turning something in on time, let me know ahead of time if possible. In all instances, communicate with me so we can prevent problems.

Learning Performance Evaluation

To accommodate different learning styles in this course, we will use interdisciplinary research projects, research presentations, mini-investigations, in-class participation, and content exams to evaluate your group and individual performance. Most course assignments will be collected within a LiveText portfolio. Both formative and summative assessments will be used to determine a final grade.

Assignment	Points
NSES Prior Knowledge	50
Research Proposal	50
Mini-Investigations/Research Journals	100
Content Exams	250
Research Project	200
Research Presentation	100
Course Portfolio	200
In-class Participation	50
Total	1000

Grading Scale and Performance Characteristics

900-1000 pts (A- to A), 800-899 (B- to B+), 700-799 (C- to C+), 600-699 (D- to D+), and 0-599 (F). Please see the CWU Catalog for the eligibility requirements for an incomplete (I).

Explanation of Assignments and Activities

Students will participate in collaborative groups to actively explore science content related to the environment. Class discussions will cover assigned readings as well as introduce new material, and will focus on current issues in alternative energy. Students will carry out an

investigative research project and publicly present their findings to the community.

NSES Prior Knowledge (50 points)
Your prior disciplinary knowledge will be evaluated initially to determine what areas need improvement and to provide a starting point for development of interdisciplinary knowledge. Your initial results will then be summarized in your LiveText portfolio introduction. This will provide disciplinary knowledge context for improvements made during the term.

Research Proposal (50 points)
A small team of students will design and conduct an inquiry-based research project based on a question of their own choosing and materials availability. To begin this process, each team will need to collaboratively construct a proposal that provides: 1) a general overview of the project that includes the research question, 2) identifies testable null and alternative research hypotheses that involve comparisons of your chosen independent variable, 3) specific predictions that describe what you think the research outcomes will be based on your independent variables, and 4) the experimental design that specifically describes the methods and materials you plan to use to conduct the experiment.

Mini-Investigations/Research Journal (100 points)
Much of the time in this class will be spent actively investigating interdisciplinary phenomena. We will be conducting a series of in-class experiments that help us develop more disciplinary knowledge so we can use that to develop interdisciplinary knowledge. In-class experiments may be done by individuals or by small groups. Your ability to engage in inquiry processes will be assessed using Research Journals.

Mid-terms and Final Exams (250 points)
Exams will contain both written and performance components. They will assess the content and process skills we have covered in class and will include questions based on the discussions we have. Two exams will be given during the course plus a two hour final exam. Exam format may be written or oral.

Research Project (200 points)
Each team will carry out an investigative research project based on the proposal. Each team will create a science research poster using PowerPoint. Each poster must include the following elements: 1) *Background* (establishes relevance for reader and context for experiment with literature), 2) *Question* (research question that you are investigating), 3) *Hypothesis* (null and alternative hypotheses), 4) *Predictions* (specifics on what you think will happen), 5) *Materials* (explicit enough for someone else to repeat your experiment), 6) *Methods* (includes analytical procedures (possibly including a flow diagram, chart, or picture); written in past tense), 7) *Qualitative Results* (descriptive, observations, pictures, 8) *Quantitative Results* (graphical, quantitative, measurement-based), 9) *Discussion* (includes analysis of data relationships, experiment caveats (controlled and uncontrolled variables), and suggestions for future improvement), 10) *Conclusions* (concise yet informative and solidly based on collected data; answers research question), and 11) *References* (formatted using APA 5th; only one or two websites allowed).

Research Presentation (100 points)
Each student team will present the results of their research to community and academic stakeholders and fellow classmates. Presentations must be constructed using PowerPoint and each group should have handouts prepared ahead of time. Each group member must be professionally attired and fully versed in all aspects of the research. Since your research presentations will be presented to the community at large, it is essential that you conduct yourself with the utmost professionalism and decorum.

Course Portfolio (200 points)
Most of the work you produce this quarter will be contained within a course portfolio. You will be required to showcase your knowledge and skills development by posting your work and reflecting on your performance relative to professional standards. This portfolio will enable you (and me) to gain a greater understanding of your progress over time, not just provide a

snapshot of what you have learned at the end of the course. Your portfolio is a large project that will be constructed as you go along; this will require some work toward the end of the term as well. Your teaching portfolio must be submitted in LiveText according to the template provided by the instructor. Each portfolio will be evaluated using to a portfolio evaluation rubric.

Bibliographic References

- *National Science Education Standards*, National Research Council, National Academy Press, Washington D.C., 1996.
- *Benchmarks for Science Literacy*, American Association for the Advancement of Science, Oxford University Press, New York, 1993.
- *Science for All Americans*, American Association for the Advancement of Science, Oxford University Press, New York, 1990.
- *Washington State Grade Level Expectations in Science*, OSPI, 2004.
- *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning,* (2002) State Education and Environment Roundtable, San Diego, CA.

ADA Statement

Students who have special needs or disabilities that may affect their ability to access information and/or material presented in this course are encouraged to contact me or the Office of Student Assistance on campus at 963-2171 for additional disability related educational accommodations.

Tentative Class Schedule

Week	***Activities***
September 25, 2006	Introductions, syllabus, Bb and LT, CT and scientific literacy
October 2, 2006	Prior knowledge assessment, research questions, define scope
October 9, 2006	Revise questions, research proposals, field trips
October 16, 2006	Revised research proposals, field trips, **Exam 1**
October 23, 2006	Learning the tools, initial data collection
October 30, 2006	Independent research, facilitated discussion
November 6, 2006	Independent research, data analysis, facilitated discussion
November 13, 2006	Data analysis, research poster, **Exam 2**
November 20, 2006	Research posters due, presentation work
November 27, 2006	Poster presentations to stakeholders, portfolios due
December 5, 2006	**Final Exam**