Spring 2-1-2007

C&I 404.01: Teaching Science K-8

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University of Montana
C & I 404: Teaching Science K-8
Spring 2007

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Office Hours:	As posted or by appt.	**Class Hours**:	T/R: 9:40-11:00

Take Chances! Make Mistakes! Get Messy! – Ms. Frizzle

Required Readings:

- Lawrence Hall of Science (2001). Great explorations in math and science: Liquid explorations. University of California at Berkeley.

- Lawrence Hall of Science (2005). Great explorations in math and science: Living with a star. University of California at Berkeley.

- NRC. (1996).National science education standards. Washington, DC: National Academy Press.

- Membership in the National Science Teachers Association. Membership includes a subscription to Science and Children, Science Scope or Science Teacher and online access to all journal archives – a veritable feast of science teaching ideas. Visit http://www.nsta.org/ to register.

Course Description

Welcome to Methods of Teaching Elementary Science! How do K-8 students construct science understandings? Which classroom conditions foster opportunities for students to learn and enjoy science? What teaching strategies engage students in doing and understanding science? These questions will be the guiding framework for this course. You will explore these questions by reflecting on your own and others' science learning and teaching, and through reading and discussing research about science teaching and learning. We will pay particular attention to the inquiry approach modeled by the National Science Education Standards. Class experiences are designed to help you be able to:

1. Present and defend your beliefs about elementary science teaching and learning;
2. Explain how students' science ideas influence learning and use questioning strategies to reveal students' science understandings;
3. Differentiate between elementary science experiences which teach both content and inquiry from those that do not;
4. Use teaching strategies that facilitate student interest and learning in science and are consistent with an inquiry teaching/learning model;
5. Plan learning sequences which integrate science across the curriculum using a model of conceptual change teaching;
6. Apply research to the selection, comparison, and implementation of elementary science curriculum;
7. Understand ways to assess student learning in science; and,
8. Reflect upon your science teaching, noting areas of mastery and areas of emerging growth.

Expectations

This is a course in which all students will be active participants. You must be more than physically present—you must make positive contributions to the ongoing learning of others. Students are responsible for class preparation and discussions during the class period. Preparing for class will involve reading the assigned materials, as well as identifying and reading additional resources. Regular attendance is expected. Due to the nature of the course, attendance, participation, and discussion are crucial components in achieving the course objectives. Absentees are responsible for any in-class announcements, changes in the syllabus, and material discussed in class.

Assignments are due in class on the dates listed. Late assignments will not be accepted unless prior arrangements have been made with the instructor. Assignments will be graded using criterion-referenced methods, i.e., a specific set of standards. As a general guide, a "C" grade represents average work. It means that all assignments are done as described. A "B" grade represents above average work. It indicates that self-initiative has been taken to research topics and bring more to the assignment than just required. An "A" grade represents a high level of mastery with evidence of reflection and research as well as personal innovation, relevant applications, and extensions. **Should you have any questions concerning a grade, I am always happy to discuss them but ask that you make an appointment so I can give the matter careful consideration and maintain confidentiality.**

It is important to remember that effort alone does not necessarily guarantee above average grades; rather, high quality thought and products ensure above average grades. To meet professional presentation standards required of practicing teachers, your assignments must be word-processed, concisely written, fully referenced, and stapled.

A final note, I know the block schedule is tight, so eating in class is hard to avoid. If you bring food and drink with you, please be sure to dispose of it appropriately. Also, because this is a large group in such a small space, please remember to show respect for your fellow classmates. Outside conversations, newspapers in class, cell phones, and tardiness are a real distraction to other students.

Sequence of Topics & Evaluation

Part I:
Topics: The nature of science, science standards, inquiry, process skills
Assessment: GEMS; Learning Journal; Standards Paper
Due Date: January 30; February 1; February 15

Part II:
Topics: Students' science ideas, teaching for conceptual understanding, 5E's
Assessment: Science Lesson & Concept Analysis; Learning Journal
Due Date: March 8; March 22

Part III:
Topics: Integrating science; culturally responsive science curricula; assessment
Assessment: Learning Journal; Thematic Unit
Due Date: April 5; April 30

Part IV:
Topics: Spatial Literacy
Assessment: Attend Geospatial Technology Workshop. (A full letter grade will be deducted for each day not in attendance.); Google Earth Scavenger Hunt
Due Date: April 24, 26, May 1, 3; May 3

Course Assignments

Participation/In-class Activities: This is due daily or as announced. Your attendance and participation are highly valued. I will take roll each class session and give one point for each full class attended.

Learning Journal: Each student will complete weekly journal entries related to course readings or explorations as a tool for reflection and self-guided learning. Unless otherwise noted in class, journal entries will include the following reflective elements: *description* – review the knowledge or event(s) presented; *metacognition* – describe your thoughts, assumptions, beliefs, values and/or attitudes prior to the experience; *analysis* – explain the reasoning and thinking behind the practices/information presented; *evaluation* – identify the implications of the ideas/practices described as well as aspects of the information that were beneficial or confusing; and *reconstruction* – describe the changes that might be made in your thinking and plans for future action. **Learning Journals will be collected in class on: 2/1, 3/22, & 4/5.**

Standards Paper: Schools across the nation are reviewing their curriculum to ensure that it aligns with the *National Science Education Standards*. It is important for you to understand what the standards define as best practice and be able to identify non-example and example best-practice science lessons. In this paper, you will identify and print one best-practice science lesson (this lesson must come from one of the following sources: Science Scope or Science and Children; the journal must be dated 1996 or later) and one science lesson that does not model best science practices (this may come from textbooks, curriculum modules, internet, etc.). Your discussion section will provide evidence from the research for your choices, discuss where the lesson is aligned with the NSES content standards, and provide adaptations for the non-example to align it with the standards. This paper, **done individually**, is due **February 15th.**

Science Fair Judging: We have been asked to help out two local schools with their science fair judging. This will require either a Friday morning or afternoon spent in the schools. You may be responsible for hosting a science fair someday so this is an excellent opportunity to see how it is done! The first science fair will be held on **February 16** at Lolo School from 9:30-11:00 and 12:30-2:00. The second one will be held in April at Hellgate Elementary on **April 27th** from 8:45-11:00. **You are required to attend one of these science fairs.**

Lesson Study: You will work with a team to present a 15-20 minute guided inquiry lesson to approximately fifteen of your peers on **January 30th**. The goal will be to work together to improve specific classroom practices that you identify (e.g., facilitating a discussion, asking questions) and gain proficiency in the use of exemplary elementary science curriculum as recognized by the National Science Teacher's Association. Each lesson uses common household items which you and your team members will supply.

Science Lesson & Concept Analysis: "Let's do it again!" Those four words are a strong indication that your students are engaged. Mastery of facilitating meaningful science learning opportunities for your students can best be measured by performance. This assignment will have several parts, each designed to familiarize you with the components of a science lesson based on teaching for conceptual understanding.

For your first step, you and your partner will identify your science topic area and science concept to be taught. Your cooperating teacher will help you with the concept selection. After selecting your science concept to be taught, you will need to learn as much as you can about the concept. The second part of the assignment will be to develop a 5 E's science lesson plan to teach to elementary students as part of your field experience. A detailed lesson plan format will be provided in class. A draft lesson plan will be developed and reviewed with your instructor during **a 20 minute private conference that your team schedules with me during week five**. The draft should be as complete as possible.

Effective science teaching requires that students first be made aware of their existing science ideas. As part of your science lesson you teach in the field, you and your partner will develop a strategy to reveal students' pre-existing science ideas. This may be a student drawing, concept map, prediction sheet, etc. You will ask students to revisit these at the end of your lesson and reflect on their current science understandings. **Your science lesson must be taught during week six**.

In the third part of this assignment, you and your partner will complete a teaching analysis of the science lesson. In your analysis you will report on your assessment of the students' understanding of the science concept based on the data you collected when revealing students' science ideas. A detailed outline of analysis expectations will be provided in class. **The final lesson draft and concept analysis is due on March 8**.

Thematic Unit Plan. When you begin classroom science teaching, a primary task you will face is developing curriculum in the form of units. For this major course assignment, you will work with a partner to design and implement a series of lessons at a local elementary school. This assignment is an integral part of your field experience and is described in depth in your field experience seminar. **You will have an opportunity to share your thematic unit with your peers during finals week. Details and times for this will be provided in seminar.**

Geospatial Technology Workshop: As part of this class, you will receive a two-week inservice in geospatial technology: Google Earth, Geoviewer, GIS and GPS. Geotechnologies integrate science, social studies, math, technology and literacy. GIS is a powerful data analysis tool used for organizing, manipulating, creating, analyzing, and mapping data. To receive full credit, you must attend all of the sessions. Google Earth assignment is due **May 3.**

Accommodations

Please contact me following the first class meeting to arrange any teaching/learning accommodations you require.

Graduate Students

The Graduate School assumes that graduate students are taking this course for graduate credit. Please see me by the end of the second week to discuss the graduate seminar required for graduate credit. If you do not want graduate credit, contact the Graduate School immediately to make the necessary changes in your registration.

Academic Misconduct

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/SA/VPSA/index.cfm/page/1321.

Tentative Course Schedule

Week 1

1/23 THE NATURE OF SCIENCE: What is science and why teach it?
Reading: 1) Capobianco, B., & Thiel, E. (2006). *Are you UV safe?* Science and Children

1/25 THE NATURE OF SCIENCE cont'd
Reading: 1) Reeves, C., & Chessin, D. (September 2003). *Did you really prove it?* Science Scope.
Assignment: Fair Test

Week 2

1/30 ELEMENTARY CURRICULUM LESSON STUDY: GEMS
Readings: 1) Liquid Explorations, Lawrence Hall of Science
Assignment: GEMS Lesson

2/1 SCIENCE STANDARDS: How do I know what/how to teach?
Reading: 1) National Science Education Standards, Chapter 6
Assignment: Learning Journal

Week 3

2/6 SCIENCE AND INQUIRY: Defining inquiry and process skills.
Readings: 1) Ohana, C. (September 2006). *Defending inquiry.* Science and Children. 2) Bonebrake-Barriger, L. & Saunders, D. (July 2006). *The case of the disappearing snack.* Science and Children.

2/8 CHILDREN'S SCIENCE IDEAS: How do children's science ideas influence learning? The Private Universe
Reading: 1) Keeley, Eberle, & Farrin (Jan. 2005). *Formative assessment probes: Uncovering students' ideas in science.* Science Scope. 2) Nam-Hwa Kang & Howren (Sept. 2004). *Teaching for conceptual understanding.* Science and Children.

Week 4

2/13 ASSESSING MENTAL MODELS: How do you reveal children's ideas about science? How can I develop a productive questioning strategy to help students plan investigations?
Readings: Furtak & Ruiz-Primo (January 2005). *Making students' thinking explicit during scientific inquiry.* Science Scope.

2/15 TEACHING FOR CONCEPTUAL UNDERSTANDING: How do I plan and write a lesson plan using the 5 E's strategy?
Readings: TBA
Assignment: Standards Paper

2/16 **LOLO SCIENCE FAIR**

Week 5

2/20 **LESSON CONFERENCES**

2/22 **LESSON CONFERENCES**

Week 6

2/27 **TEACHING MATH, SCIENCE, & SOCIAL STUDIES LESSONS IN THE SCHOOLS!!**

3/1 **Lessons in the schools cont'd**.

Week 7

3/6 SCIENCE ASSESSMENT How do you assess students' ability to do inquiry? To understand and apply science concepts?
Readings: 1) National Science Standards, Chapter 5.

3/8 SCIENCE ASSESSMENT cont'd
Readings**:** 1) Sterling, D. (January 2005). *Assessing understanding.* Science Scope. 2) Hammerman, E. (Jaunary 2005). *Linking classroom instruction assessment*. Science Scope. 3) Harnden, J. (January 2005). *Scientific inquiry scoring guides.* Science Scope.
Assignment: Lesson Plan and Analysis Due

Week 8

3/13 SCIENCE, ENGINEERING, TECHNOLOGY AND DESIGN: Integrating technology and design into the science classroom.
Readings: 1) Cabe-Trundle, K., Sandra Willmore, S. & Smith, W. (March 2006). *The moon project.* Science and Children.

3/15 SCIENCE, ENGINEERING, TECHNOLOGY AND DESIGN cont'd
Readings: 1) Macduff, J. (September 2006). *Yes! We are rocket scientists.* Science Scope.

Week 9

3/20 SCIENCE, ENGINEERING, TECHNOLOGY AND DESIGN cont'd
Readings: TBA

3/22 SCIENCE, ENGINEERING, TECHNOLOGY AND DESIGN cont'd
Assignment: Learning Journal

Week 10

3/27 **SPRING BREAK**

3/29 **SPRING BREAK**

Week 11

4/3 CULTURALLY RESPONSIVE SCIENCE CURRICULUM: What is it and how can I use it to support Native knowledge systems?
Readings: TBA

4/5 SCIENCE-LITERACY CONNECTIONS: Integrating science into your literacy program.
Readings: Miller, R. (Nov/Dec 2004). *Making thinking visible.* Science and Children
Assignment: Learning Journal

Week 12

4/10 **THEMATIC WORK SESSION**

4/12 **THEMATIC TEACHING!**

Week 13

4/17 **THEMATIC TEACHING!**

4/19 **THEMATIC TEACHING!**

Week 14
4/24 GEOSPATIAL TECHNOLOGY Workshop

4/26 GEOSPATIAL TECHNOLOGY Workshop

4/27 **HELLGATE SCIENCE FAIR**

Week 15
5/1 GEOSPATIAL TECHNOLOGY Workshop
Reading: TBA

5/3 GEOSPATIAL TECHNOLOGY Workshop
Assignment: Google Earth

Week 16
Final Exam Meeting Times: Section One: Tuesday, May 8, 10:10-12:10 ED 113
Section Two: Tuesday, May 8, 1:10-3:10 ED 215

Grading Policy

Final grades will be calculated based on the following percentages of total points:

A	95-100
A-	92-94
B+	90-91
B	87-89
B-	84-86
C+	81-83
C	78-80
C-	76-77
D	68-75
F	Below 68

Assignment	Value
Participation	10%
Science Fair Judging	5%
Learning Journal	20%
Lesson Study	5%
Standards Paper	15%
Science Lesson/Concept Analysis	20%
Geospatial Technology Project	10%
Thematic Unit Plan	15%

Please note that this document serves as a guide for course content and student evaluation. I welcome student input and reserve the right to be a learner as well as a facilitator. Thus, I may adjust this guide as the semester proceeds. Any changes will be announced in class.