1-2003

C&I 404.02: Teaching Science in the Elementary School

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University of Montana
C & I 404: Teaching Science in the Elementary School
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Office Hours:	As posted or by appt.	**Class Hours**:	T/R: 9:40-11:00; 12:40-2:00

I succeeded in good part because I kept asking questions concerning time and space which only children wonder about. – Einstein

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Required Readings:

- Faculty Pack: Teaching Science in the Elementary Schools, available at Denny's Copy Shop (2330 South Higgins Avenue).

- NRC. (1996). National science education standards. Washington, DC: National Academy Press. Online: http://www.nap.edu/readingroom/books/nses/html/

I encourage you to join the National Science Teachers Association. Membership includes a subscription to Science and Children, Science Scope or Science Teacher. Each is full of engaging teaching ideas and activities for your classroom.

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 student's 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.**

In cases where work is judged to be less than fair quality (75 and below), students may request consideration for a rewrite of that assignment. The request must be done within two days following the return of the assignment. The revisions must be completed within five days following the revision agreement. The grades for the revised paper and the original paper will then be averaged. **Revised papers will only be considered if they include the original paper and grading rubric.**

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 and stapled.

A final note, 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, and tardiness can be a real distraction to other students.

Sequence of Topics & Evaluation

Part I: **Topics:** The nature of science, science standards
Assessment: Standards Paper
Due Date: February 25th

Part II: **Topics:** Students' science ideas, conceptual change teaching model, inquiry cycle
Assessment: Science Lesson & Concept Analysis
Due Date: April 3rd

Part III: **Topics:** Integrating science
Assessment: Thematic Unit
Due Date: May 5th

Part IV: **Topics:** Science assessment - performance based assessment, portfolios, scoring rubrics, science journals, concept mapping, . . .
Assessment: Science Assessment Interview
Due Date: Samples are due April 15th; paper is due May 8th

Part V: **Topics: Science teaching resources**
Assessment: Attend GIS/GPS workshop taught by the EOS Education Center Staff

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.

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 copy one best-practice science lesson (**this lesson must come from one of the following sources: *Science Scope* or *Science and Children* and the journal must be dated 1997 or later**) and one science lesson that does not model best science practices (this may come from textbooks, curriculum modules, internet, etc.). **A copy of both lessons must accompany your paper**.

Your discussion section will provide **evidence for your choices from the research and the NSES**, outline where the lesson is aligned with the NSES content standards, and provide adaptations for the non-example to align it with the standards. Support for your decisions must come from the literature, not from what you as a student believe or feel. Schools are being required by recent NCLB legislation to use curriculum that is supported by "scientifically-based research." We will discuss the limitations of this model, but it is critical for your professional career that you know what this means and can communicate it to parents and administrators. This assignment will help you understand what "research-based curriculum choices" means for teachers.

Non-example lesson adaptations must be specific and include questions, student explorations . . . Statements such as, "I would make it more hands-on," or "I would ask more questions," are not appropriate. **The standards paper is due February 25th**.

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 conceptual change science lesson plan to teach to elementary students as part of your field experience. A detailed lesson plan format is provided in your faculty pack. 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 the week of March 10-14**. The draft should be as complete as possible. **The draft lesson plan, completed jointly by you and your partner, will be turned in on Friday, March 7th**.

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 will be taught during week eight**.

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 is provided in your faculty pack.

For the last part of this assignment, you and your partner may be asked to submit your lesson plan for publication consideration to the online Virtual ERIC library of science lessons. Details for this will be provided in class. **The final lesson draft and concept analysis is due on April 3**.

Science Scope, Sequence, & Assessment Analysis: According to the TIMSS research, the most often cited reason for why US science students lag behind their international counterparts is that there is a lack of articulation and depth of the science curriculum and ineffective performance measures of the science teaching/learning experience. What are the scope, sequence and performance measures currently being used in local elementary science programs? How have their science programs addressed the concerns of the TIMSS research?

Interview your elementary teacher to find out the scope and sequence of science content and process skills in his or her classroom and collect an example(s) of a science assessment tool he or she uses on a regular basis. How did the teacher or the school decide (who does decide?) to teach the concepts they have identified for their grade level? What are their main goals for science instruction? How do they measure these?

You will write a 2-3 page paper which includes an outline of the science scope and sequence, a copy of an assessment tool, and a brief discussion of the interview in which you: 1) Identify the kind of science assessment most often used in your field experience classroom and the merits of this science assessment approach (be sure to address the questions in the paragraph above as well); 2) Suggest one other form of science assessment appropriate for the grade level and curriculum that could be used and reasons for this suggestion; and, 3) Discuss the scope & sequence of the science content for that grade level in terms of articulation and depth of coverage.

For those of you in grades K-2, your teacher may respond that he or she does not teach science, please see me if this is the case and an alternative assignment will be provided.

You will make a copy of both the scope and sequence and the assessment measure and bring these to class on April 15th. You and your partner should be prepared to discuss these in class, either in a small or whole group setting. The paper will be due May 8th. You may choose to complete this paper with your partner or separately.

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's done! The first science fair will be held on Friday, February, February 21st at Lolo School. The second one will be held at Hellgate Elementary0. You will need to sign up for only one of these science fairs, but you are encouraged to attend both.

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.**

Tentative Course Schedule

Week 1

1/28 THE NATURE OF SCIENCE: What is science and why teach it?
Readings: The Nature of Science, FP, pp. 1-13; What is science? FP, pp. 17-25.
Assignments: Light Lesson Plan

1/30 THE NATURE OF SCIENCE cont'd
Readings: Facts, FP, pp. 26-36; Project 2061: Evidence & Reasoning, FP, pp. 14-17 or http://www.project2061.org/tools/atlas/sample/1_1_ER.htm

Week 2

2/4 SCIENCE STANDARDS: Where do I start? How do I know what/how to teach?
Readings: National Science Education Standards, pp. 1-52 (online, Chapters 1-3); 103-171 (online, Chapter 6)

2/6 SCIENCE STANDARDS cont'd.
Readings: MT Science Standards, FP, pp. 15-25; Missoula Science Standards, FP, pp. 26-70

Week 3

2/11 SCIENCE PROCESS SKILLS:
Readings: Science Process Skills, FP, pp. 102

2/13 CHILDREN'S SCIENCE IDEAS: How do children's science ideas influence learning?
Introduction to the Private Universe
Readings: Children's Own Concepts, FP, pp. 108-116

Week 4

2/18 PRIVATE UNIVERSE cont'd. How can I develop a productive questioning strategy to help students plan investigations? Learning to use the Elstgeest questioning strategy.
Readings: The Right Question at the Right Time, FP, pp. 117-122.

2/20 ASSESSING MENTAL MODELS: How do you reveal children's ideas about science? Introduction to the Focus Phase of the conceptual change teaching model.
Readings: Implementing the Conceptual Change Model, FP, pp. 131-164.

Week 5

2/25 IMPLEMENTING THE CONCEPTUAL CHANGE TEACHING MODEL
Readings: Switch Off Kid's Science Misconceptions, FP, pp. 165-167; Learning About Light, FP, pp. 183-194.
Assignment: Standards Paper due.

2/27 VIEWING/REFLECTING CONCEPTUAL CHANGE SCIENCE LESSON
Readings: Conceptual Change Lesson Plan Outline, FP, pp. 204-238

Week 6

3/4 ELEMENTARY SCIENCE CURRICULA: What curricula can I expect to find in the schools to support my science teaching?
Readings: Project 2061 Curriculum Analysis Rubric, FP, pp. 305A –305C; Magnet Unit, FP, pp. 240-278.

3/6 NURTURING OPEN INQUIRY USING THE INQUIRY CYCLE & DISCOVERY BOXES
Readings: Getting Started, FP, pp. 306-318; Discovery Boxes, FP, pp. 319-336.

Week 7

3/11 OPEN INQUIRY cont'd
Readings: Using Cooperative Learning with Science Instruction, FP, pp. 279-305.

3/13 **LESSON CONFERENCES**

Week 8

3/18 **TEACHING MATH, SCIENCE, & SOCIAL STUDIES LESSONS IN THE SCHOOLS!!**

3/20 **TEACHING MATH, SCIENCE, & SOCIAL STUDIES LESSONS IN THE SCHOOLS!!**

Week 9

3/25 **SPRING BREAK!!**

3/27 **SPRING BREAK!!**

Week 10

4/1 INTEGRATING USING SCIENCE AND DESIGN: Supporting inquiry through children's engineering projects and the Design Cycle teaching model.
Readings: Case Studies, FP, pp. 336A-336D

4/3 INTEGRATING USING DESIGN cont'd
Readings: Primary Children and Problem Solving, FP, pp. 336-367
Assignment: Science Concept & Analysis due.

Week 11

4/8 ASSESSMENT: How do you assess students' ability to do inquiry? To understand and apply science concepts?
Readings: National Science Education Standards, pp. 75-101 (online, Chapter 5)

4/10 SCIENCE ASSESSMENT: Tools for Assessment
Readings:. Tools for Assessing What Students Know About Inquiry, FP, pp. 410-444

Week 12

4/15 SCIENCE ASSESSMENT: Interpreting & Scoring Children's Work
Assignment: Bring scope, sequence and assessment samples to class for discussion.

4/17 **THEMATIC TEACHING!**

Week 13

4/22 **THEMATIC TEACHING!**

4/24 **THEMATIC TEACHING!**

Week 14

4/29 GIS Teacher Workshop, Todd Building, Room 210

5/1 GIS Teacher Workshop, Todd Building, Room 210

Week 15

5/6 GIS Teacher Workshop, Todd Building, Room 210

5/8 GPS Teacher Workshop, Todd Building, Room 210
Assignment: Scope, sequence & assessment paper due May 8th.

Week 16

Final Exam Meeting Times:	Section One	-	Monday, May 12th, 8:00 - 10:00
	Section Two	-	Wednesday, May 14th, 1:10-3:10

Grading Policy

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

A	92-100
B	84-91
C	76-83
D	68-75
F	Below 68

Assignment	Value
Participation/GIS	15%
Standards Paper	20%
Science Lesson/Concept Analysis	20%
Assessment Interview	20%
Thematic Unit Plan	25%