California State University San Marcos
College of Education

EDMS 545 - Elementary Science Education

Spring 2005
8:00-2:15

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RequiredTextbooks:

Teaching Children Science. An Inquiry Approach By Alfred E. Friedl. NY: McGraw-Hill.

California Science Framework

COURSE DESCRIPTION

This course is designed to provide a comprehensive overview of the objectives, skills, concepts, experiments, materials, and methods necessary to teach science to elementary school children. A series of group activities will provide you with first-hand experiences in these areas. This course focuses on instructional methods, techniques, materials, lesson planning, curriculum development, organization and assessment in science. The integration of curricular areas is addressed. Methods of cross-cultural language and academic development will be integrated in to the course.

COURSE OBJECTIVES

By the end of this course, students should be able to

1. Demonstrate proficiency with inquiry skills of observing, measuring, inferring, classifying, predicting, verifying predictions, hypothesizing, isolating variables, interpreting data, and experimenting.
2. Identify exemplary materials (curriculum kits, science programs, textbooks, equipment, technology, ancillary materials) appropriate for elementary school children.
3. Demonstrate knowledge and understanding of the California Science Framework, the California Science Content Standards, and the National Science Education Standards.
4. Demonstrate an understanding of the physical, earth and life science concepts included in the K-8 California Science Content Standards, and how to design lessons to teach the concepts.
5. Use the Learning Cycle model of instruction to teach science in a contemporary manner.
6 Use technology in elementary science teaching.
7. Demonstrate confidence in leading and performing investigations designed to teach science concepts, science process skills, and scientific attitudes. .
8. Use authentic methods of assessment to evaluate student learning of science concepts and processes.
9. Design a 3-lesson elementary science teaching unit .
10. Practice strategies to include all students in science (linguistically and culturally diverse, students with disabilities and other students with special needs).

COE MISSION STATEMENT

The mission of the College of Education Community is to collaboratively transform public education by preparing thoughtful educators and advancing professional practices. We are committed to diversity, educational equity, and social justice, exemplified through reflective teaching, life-long learning, innovative research and on-going service. Our practices demonstrate a commitment to student-centered education, diversity, collaboration, professionalism, and shared governance. *(Adopted by COE Governance Community, October, 1997).*

Authorization to Teach English Learners

This credential program has been specifically designed to prepare teachers for the diversity of languages often encountered in California public school classrooms. The authorization to teach English learners is met through the infusion of content and experiences within the credential program, as well as additional coursework. Students successfully completing this program receive a credential with authorization to teach English learners.
(Approved by CCTC in SB 2042 Program Standards, August 02)

Teacher Performance Expectation (TPE) Competencies

The course objectives, assignments, and assessments have been aligned with the CTC standards for Multiple Subject Credential. This course is designed to help teachers seeking a California teaching credential to develop the skills, knowledge, and attitudes necessary to assist schools and district in implementing effective programs for all students. The successful candidate will be able to merge theory and practice in order to realize a comprehensive and extensive educational program for all students. You will be required to formally address the following TPEs in this course:

A. MAKING SUBJECT MATTER COMPREHENSIBLE TO STUDENTS

TPE 1A: Subject-Specific Pedagogical Skills for Multiple Subject Teaching Assignments - Teaching Science in a Multiple Subject Assignment

Candidates for a Multiple Subject Teaching Credential demonstrate the ability to teach the state-adopted academic content standards for students in science (K-8). They balance the focus of instruction between science information, concepts, and investigations. Their explanations, demonstrations, and class activities serve to illustrate science concepts and principles, scientific investigation, and experimentation. Candidates emphasize the importance of accuracy, precision,

C. ENGAGING AND SUPPORTING STUDENTS IN LEARNING

TPE 5: Student Engagement

Candidates for Teaching Credentials clearly communicate instructional objectives to students. They ensure the active and equitable participation of all students. They ensure that students understand what they are to do during instruction and monitor student progress toward academic goals. If students are struggling and off-task, candidates examine why and use strategies to re-engage them. Candidates encourage students to share and examine points of view during lessons. They use community resources, student experiences, and applied learning activities to make instruction relevant. They extend the intellectual quality of student thinking by asking stimulating questions and challenging student ideas. Candidates teach students to respond to and frame meaningful questions.

College of Education Attendance Policy

Due to the dynamic and interactive nature of courses in the College of Education, all students are expected to attend all classes and participate actively. At a minimum, students must attend more than 80% of class time, or s/he may not receive a passing grade for the course at the discretion of the instructor. Individual instructors may adopt more stringent attendance requirements. Should the student have extenuating circumstances, s/he should contact the instructor as soon as possible. *(Adopted by the COE Governance Community, December, 1997).*

Students with Disabilities Requiring Reasonable Accommodations

Students must be approved for services by providing appropriate and recent documentation to the Office of Disable Student Services (DSS). This office is located in Craven Hall 5205, and can be contacted by phone at (760) 750-4905, or TTY (760) 750-4909. Students authorized by DSS to receive reasonable accommodations should meet with their instructor during office hours or, in order to ensure confidentiality, in a more private setting.

CSUSM Academic Honesty Policy

"Students will be expected to adhere to standards of academic honesty and integrity, as outlined in the Student Academic Honesty Policy. All written work and oral assignments must be original work. All ideas/materials that are borrowed from other sources must have appropriate references to the original sources. Any quoted material should give credit to the source and be punctuated with quotation marks.

Students are responsible for honest completion of their work including examinations. There will be no tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty in accordance with the general rules and regulations of the university. Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole."

TOPICS OUTLINE

The Learning Cycle Model of Teaching
Learning Cycle Science Lesson demonstrations
Writing Objectives and Explanations of Science Concepts
CA Science Content Standards Grades K-8
California Science Framework
SDAIE Strategies in Science
Infusing Writing Activities in Science Lessons
Science Curriculum Kits and State Approved Texts
Science Process Skills and Scientific Attitudes
Current Issues in Science Education
Infusing Technology into Science Teaching
Authentic Assessments in Science
Science Projects, Student Research, Science Fairs
Safety in the Science Class
Inclusion and Teaching Science to Students with Special Needs

COURSE ASSIGNMENTS

1. Reading Responses *(due for each chapter, turned in at end of 2nd, 4th, 6th, and78th weeks)*
2. Leadership of Hands-on Science Lessons *(beginning 2nd week; instructor models during week 1)*
3. Science Instruction Case Study *(4th week)*
4. Science Practicum with School Age Children *(5th week)*
5. Science Teaching Unit with Learning Cycle Lessons *(7th week)*

ASSIGNMENT DESCRIPTIONS

1. READING RESPONSES (ONE PER CHAPTER, DUE 2ND, 4TH, 6TH, AND 7TH WEEK)

Students will be assigned readings and should present their responses to each chapter in one of the following forms:

A. A Big Ideas paper explaining the key science concepts and example activities
B. A visual or symbolic representation of the key science concepts
C. A graphic organizer that demonstrates the key science concepts and their relationships to one another (samples will be provided in class)

The responses should be 1-2 pages and typed. They will be checked off for completion each due date. Representative samples will be examined for closer reading.

2. LEADERSHIP OF HANDS-ON SCIENCE LESSONS – Critical Assessment Task (CATs)

Students will lead hands-on science lessons during class. The lessons should model inquiry instruction, good questioning skills, and be content-understandable and non-judgmental. The lessons should be based on the California content standards. SDAIE strategies, technology integration, and methods for teaching students with disabilities should all be included and pointed out during the lesson.

You will work in groups of 4 people to lead science lessons based on the Learning Cycle Model of Instruction. You will teach these to your classmates. Each lesson will be allocated 30-40 minutes of class time to teach. Your classmates will <u>not</u> role-play elementary students, but will learn the science content and how to teach it. Treat your classmates as teachers, not elementary students.

The lessons should include hands-on lessons, and should emphasize particular science concepts. The Exploration and Application phases of the Learning Cycle must require different hands-on science activities using manipulatives. Hands-on activities are NOT reading or completing worksheets (though they may require students to read something or complete lab observation sheets). You should take the activities "off of paper" and require students to use the science process skills with science manipulatives.

Be sure you understand the concepts you are emphasizing, and that you can explain them. The lessons should be developmentally appropriate for K-6, and should follow the NSTA Safety Guidelines.
Make sure that you include the 3 stages of the Learning Cycle.
Make sure that science content background and applications to everyday life are addressed.
You need to explain SDAIE strategies and adaptations for students with disabilities.

Prepare a Powerpoint Computer Presentation to use in your lesson. The presentation should include a detailed explanation of the science content, as well as a list and definitions of science concepts important to the lesson. Additionally, include a list of at least 10 web sites (with short descriptions) that address the science topic and concepts through simulations, graphics and movies. You should have links to these web sites and show examples during the lesson. **You need to email the presentation to the instructor 2 days prior to your presentation.

Each group will prepare a handout which includes the 3 stages of the learning cycle, SDAIE strategies, adaptations for students with disabilities, a 1-2 page summary of the science content background, a list of science concepts taught (with definitions), a list of 10 relevant web sites (with descriptions), and applications to everyday life. Bring copies of the activity (for everyone) with (a) group members' names at the top and (b) reference at the bottom.. *On the first line, write out the science concept(s) you are teaching in a complete sentence. Do not say "The students will ____." (That is an objective, not a science concept.)*

Each group will prepare an evaluation instrument to be used by (a) the instructor, (b) 5 class members not in the group, (c) group members (each will complete one copy). The evaluation instruments should have the group members' names, <u>title and science topic</u> at the top. The instructor's copy should include a description of each person's role in researching and presenting.

3. SCIENCE INSTRUCTION CASE STUDY

Students will develop a case study of science instruction involving input from classroom observations, a K-8 teacher or teachers and K-8 students. It will include 5 parts: your observations, teacher interview, student surveys, chart comparison, and case study paper. Carefully read A-F below.

Observations of Science Lessons

A. Ask an elementary teacher if you can observe 2-3 science lessons in his or her class. Then answer the following:

1. How would you define science instruction in this classroom?
2. What are the characteristics of science instruction?
3. What do the students do during science instruction?
4. What materials are used?
5. How often do the students engage in hands-on activities?
6. Do they each participate and have a role?
7. How is the classroom organized for science instruction?
8. What science materials are in the classroom?
9. What evidence is there of science?
10. Do you see writing infused within the science lessons? If so, what are some examples?
11. Are their children in the class who are learning English? What differences and similarities exist for children who are learning English?

Feel free to add more descriptive information in regard to science instruction.

B After you have answered the above questions find time to interview the teacher..

Ask the teacher to answer the Teacher Survey. Please inform the teacher that the school and district will not be identified, only the grade level. Please do not put the teacher's name on the survey.

Teacher Survey

1. How do children learn science?
2. How do you organize instruction so that children learn concepts related to the California science standards?
3. What are the different activities that you do during science instruction?
4. How do you group the students during science activities?
5. How often do you teach science?
6. How often do the children participate in hands-on science activities?
7. Do you integrate writing activities into science lessons? What are some examples?
8. What is the easiest thing about teaching science?
9. What is the most difficult thing about teaching science?
10. If you could design the ideal science program, what would be the characteristics of the program?
11. How do you organize instruction for science in two languages or in a language other than English? What challenges does this present for you?
12. How do you adapt instruction for students with special needs? Are their particular techniques or issues related to science teaching and students with special needs?

Feel free to include other questions during the interview. If possible, take a portable tape recorder to record the responses for later transcription, as it is easy to miss some things when you are taking notes. Be sure to ask the teacher if she or he minds if you use the tape recorder, and do not use it if the teacher is hesitant.

C. Ask the teacher if you can hand out the Student Survey to the students in the class. Do **not** have the students put their names on the surveys. Feel free to include other questions on the survey, but do not make it too long for the student to answer. This survey will work with third graders and up; you can try it with second graders but I would suggest reading the questions aloud one at a time for them. If you are working with K, 1 or 2 use the following alternative strategy: Choose approximately 6 students (if you are in a bilingual class choose 3 who have English as their native language and 3 with Spanish or whatever other language is spoken in the class). Interview each student using the survey questions. Record the answers, if possible, and transcribe the taped interviews.Be flexible and adapt the survey to the level of the students.

Student Survey

Please answer the following questions.
Grade level: _____ Are you a Boy ❒ Girl ❒ ?
What language(s) do you speak? English ❒ Spanish ❒ Other ❒

1. What happens during science in your class? How does your teacher teach you science?
2. How often do you do hands-on science activities in class?
3. What sorts of science activities do you do in class?
4. Do you work in groups to do science activities? If so, what do you do in the groups? Does each person have a job to do?
5. Do you have science materials to use during science activities? What sorts of materials do you use?
6. What are some of the science topics you have studied this year in science class?
7. Do you like science time? What do you like best about it?
8. Are you a good student in science? What helps you learn best?

D. Examine the three sets of data (your observations, those of the teacher and students) for matches and mismatches. Create a grid to organize the data:

Comparison Chart

	My Observations	Teacher Interview	Student Surveys
How is science taught?			
How does the teacher teach science?			
Do the students participate in hands-on science activities?			
Adaptations and Accommodations			

E. Using the data you have collected and the match/mismatch chart, type a 2-3 page CASE STUDY PAPER of the science instruction.

F. Turn in the following. Staple all together in the following order with the Case Study paper on top.
   1. Your 2-3 page Case Study Paper.
   2. Your own answers to questions (in A above) as you observed in the classroom
   3. Teacher Interview questions (B above) and answers
   4. Student Surveys (C above) with student answers
   5. Comparison Chart of your observations, teacher interview answers and student survey answers.

   Please turn in two copies of anything you wish returned to you.

4. SCIENCE PRACTICUM WITH SCHOOL AGE CHILDREN – Critical Assessment Task (CATs)

Develop an inquiry activity to teach to elementary students.

_____

You will prepare a hands-on science lesson and poster about a science concept. You will present the lesson at our Elementary School Science Exposition. Be sure you understand the concept(s) you are emphasizing, and that you can explain it. The activity should be developmentally appropriate, and should follow the NSTA Safety Guidelines. Prior to teaching the lesson, turn it in to your instructor for review. After teaching the lesson, turn in a copy of your Lesson and your Reflection. The lessons should include hands-on lessons, and should emphasize particular science concepts. The Exploration and Application phases of the Learning Cycle must require different hands-on science activities using manipulatives. Hands-on activities are NOT reading or completing worksheets (though they may require students to read something or complete lab observation sheets). You should take the activities "off of paper" and require students to use the science process skills with science manipulatives.)

Turn in the following:

1. Type the lesson.
2. Include your name at the top of the page and references at the bottom of the page.
3. Science Concept you are teaching. Write it out in a complete sentence. Do not say "The students will ____." (That is an objective, not a science concept.)
4. California Science Content Standards and Investigation Standards addressed
5. 1-3 Learning Objectives
6. Exploration Activity
7. Concept Invention
8. Concept Application Activity
9. The Reflection (answer the following):
   - How did the children respond? (What did they say and do?)
   - How do the children's actions and responses demonstrate their level of understanding.
   - How did you (or can you) improve upon your lesson to facilitate understanding?

5. SCIENCE TEACHING UNIT – Critical Assessment Task (CATs)

You will create a typed unit on a specific science topic. You must bring a stamped, self-addressed manila envelope in order to receive a final grade. (You may work in pairs on this assignment.)

1. Unit Plan (1 page-include title, grade level, goals for unit, Calif. Science Content Standards addresses, and one-two line descriptions of each learning cycle lesson)
2. 4 Learning Cycle Lesson Plans *Adapt from Commercial Lessons!*

   For each lesson, include the following: *Do not re-invent activities*.
   a. Topic
   b. Science Concept you are teaching. Write out the science concept(s) you are teaching in a complete sentence. Do not say "The students will ____." (That is an objective, not a science concept.)
   c. California Science Content Standards and Investigation Standards addressed
   c. Objectives (1-2) (use behavioral objectives with action verbs—i.e., The students will ___)
   d. Exploration Activity- explain what students will do and what teacher will do

e. Concept Invention --explain what students will do and what teacher will do
f. Concept Application Activity- explain what students will do and what teacher will do
g. Authentic Assessment
h. Rubric for Assessment
i. SDAIE Strategies and explanation of how used
j. Adaptations for Students With Disabilities and explanation of how used
k. 3 Ways to Integrate Technology and Explanation of how used

3. Science Content Background (3-5 pages—typed pages)
4. List and short descriptions of 10 Web Sites (with short descriptions) that address the science topic and concepts through simulations, graphics and movies.
5. References

The lessons should include hands-on lessons, and should emphasize particular science concepts. The Exploration and Application phases of the Learning Cycle must require different hands-on science activities using manipulatives. Hands-on activities are NOT reading or completing worksheets (though they may require students to read something or complete lab observation sheets). You should take the activities "off of paper" and require students to use the science process skills with science manipulatives.

CRITERIA FOR GRADING ASSIGNMENT

A	Outstanding work on assignment, excellent syntheses of information and experiences, great insight and application, and excellent writing.	90-100%
B	Completion of assignment in good form with good syntheses and application of information and experiences; writing is good.	80-89%
C	Completion of assignment, adequate effort, adequate synthesis of information and application of information and experiences, writing is adequate.	70-79%
D	Incomplete assignment, inadequate effort and synthesis of information, writing is less than adequate.	60-69%

Late assignments will be penalized by a 10-point reduction each day they are late.

GRADING STANDARDS

Attendance / Participation	**10 points**
Peer Teaching	**10 points**
Resource Notebook	**15 points**
Case Study	**15 Points**
Exploatorium Activity	**20 points**
Science Teaching UNIT	**20 points**
TaskStream	**10 points**
TOTAL	**100 points**

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Date	Topic	Reading DUE	Assignments DUE
January 19	**Orientation** -Course Overview -Discrepent Event -Peer Teaching **Frameworks**	(In class) Friedl: Ch.1,2,3	
January 26	**Physical Science** -Characteristics of Matter -Heat Energy -Magnetism	Friedl: Ch.4,5, 6	**Resource Notebook Chapters 1-6** (Peer Teaching) Hands-on Science #1,2
February 2	**Physical Science** -Current/Static Electricity -Sound -Light, Lenses and Color	Friedl: Ch. 7,8,9	(Peer Teaching) Hands-on Science #3
February 9	**Physical Science** -Simple Machines -Air, Air Pressure, Flight **Earth Science** -Weather and Climate -Space Science	Friedl: Ch. 10,11,12,13	**Resource Notebook Chapters 7-13** **Case Study** (Peer Teaching) Hands-on Science #4,5
February 16	**Earth Science** -Sun, Moon, Stars -Geology -Oceans -Energy, Environment and Pollution	Friedl: Ch. 14,15,16,17,	**Exploratorium Activity**
February 23	**Life Science** -Plant/ Fungi Kingdoms -Animal Kingdom	Friedl: Ch. 18,19	**Resource Notebook Chapters 14-17** (Peer Teaching) Hands-on Science #6
March 2	**Life Science** -Nutrition and Health -Fitness	Friedl: Ch. 20,21	**Resource Notebook Chapters 18-21** **Science Teaching Unit** (Peer Teaching) Hands-on Science #7
March 9	**Mock Interview**		**Taskstream**

Instructor reserves the right to modify calendar as needed.