

**California State University San Marcos  
College of Education**

**EDMS 545 - Elementary Science Education**

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**Required Textbooks:**

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

**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).

**\*\*You must go to ACD 202 to activate your CSUSM e-mail account, or provide another email address.**

## 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 ongoing service. Our practices demonstrate a commitment to student centered education, diversity, collaboration, professionalism, and shared governance.

## INFUSED COMPETENCIES

### CLAD

In 1992, the College of Education voted to infuse Cross-cultural, Language and Academic Development (CLAD) competencies across the curriculum. The CLAD competencies are attached to the syllabus and the competencies covered in this course are highlighted.

### Special Education

Consistent with the intent to offer a seamless teaching credential in the College of Education, this course will demonstrate the collaborative infusion of special education competencies that reflect inclusive educational practices.

### Technology

This course infuses technology competencies to prepare our candidates to use technologies, emphasizing their use in both teaching practice and student learning.

## COURSE REQUIREMENTS

**COE Attendance Policy:** “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.”

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. Absences and late arrivals/early departures will affect the final grade. If you miss 3 class sessions or are late (or leave early) for more than four sessions, your highest possible grade is a B. If you miss 5 class sessions, your highest possible grade is a C. If you miss more than 20% of the class (6 class sessions), you may not receive a passing grade for the course. Absences do not change assignment due dates. Late assignments will receive a 10% reduction in points for each day late. After one week, late assignments will receive no credit.

## ATTENDANCE AND PARTICIPATION

This course deals with complex material processed in a variety of ways. Structured interactions, group processes, oral presentations, guided discussion of readings, and self-disclosure exercises are the norm. Students are expected to have read assigned materials by the date indicated in the syllabus, and should be prepared to discuss readings individually or in variously structured groups. The degree of your engagement in these processes forms the basis for points assigned. Due to the fast paced and highly interactive nature of the course, regular attendance and full participation are expected: teaching and learning is difficult (if not impossible) if one is not present for and engaged in the process. Therefore, the above College Attendance Policy is amplified as follows: 1. Missing more than 1 class meeting will result in the reduction of one letter grade. 2. Arriving late or leaving early on more than two occasions will result in the reduction of one letter grade. 3. Illness and emergency circumstances will be considered/negotiated on a case-by-case basis. These measures should not be considered punitive, as students are expected to establish appropriate personal, academic and career-ladder priorities. Therefore these measures should be viewed as taking appropriate individual

responsibility for one's own learning in a democratic, collaborative and reciprocal-learning environment.

### 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. Resource Notebook
3. Peer Teaching of Hands-On Science
4. Science Action Research
5. Exploratorium Event
6. 3-5 Day Unit Plan

### ASSIGNMENT DESCRIPTIONS

- 1. RESOURCE NOTEBOOK (ONE SECTION PER CHAPTER, DUE 2<sup>ND</sup>, 4<sup>TH</sup>, 6<sup>TH</sup>, AND 8<sup>TH</sup> WEEK)**  
\*Students will complete *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.  
\*The notebook should also include a section with resources such as field trips, professional development sources, and web sites
- 2. PEER TEACHING OF HANDS-ON SCIENCE LESSONS**  
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 not 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 20 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, title and science topic at the top. The instructor’s copy should include a description of each person’s role in researching and presenting.

### **Lesson Plan Format**

**Lesson Title:** What is the title of your lesson?

**Grade Level:** What is the grade level?

**California Science Content Standard(s):** What standards are addressed? Include at least one science area (life science, physical science, or earth science) standard and one investigation standard.

**Lesson Objective(s):** What do you want students to be able to do?

Write in complete sentences. Use an action verb and explain how students will demonstrate their new knowledge and understanding. “The students will \_\_\_\_\_.”

**Science Concept(s):** What are you trying to teach?

Do not say “The students will \_\_\_\_.” (That is an objective, not a science concept.)

**Student Groupings:** How will you group students for instruction?

**Materials/Resources/Technology:** What does the teacher need? What do the students need?

**Assessment:** How will your students demonstrate that they have met the objective? Is there a clear match between the standards, objectives and the assessment?

**Lesson Procedures:** Explain the procedures for each. Include what the teacher will do and what the students will do.

- Exploration (Students should first make predictions.) (minutes?)
- Concept Invention (minutes?)
- Concept Application (minutes?)

**Accommodations/Adaptations/Applications:**

- SDAIE strategies and explanations (5)
- Adaptations for students with disabilities and explanations (5)
- Applications to everyday life and explanations (5)

**Science Content Background:** 1-2 page summary of the science content background

**Web Sites:** 5 interactive relevant web sites with descriptions

**Children's Literature Books:** Title, author, publisher, year of 5 children's books on the topic

**References:** Title, author, publisher, year of resources

### 3. SCIENCE INSTRUCTION ACTION RESEARCH

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 there 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**

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

E. Using the data you have collected and the match/mismatch chart, type a 2-3 page ACTION RESEARCH 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 Action Research 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 EXPLORATORIUM EVENT**

Develop an inquiry activity to teach to elementary students.

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You will prepare a hands-on science lesson and poster about a science concept. You will present the lesson at our Exploratorium Event. 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 – (Part of your 3-mos. Plan)

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. 3-5 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 20-point reduction each day they are late.**

## COURSE GRADES

1. Participation/Collaboration/Professionalism	10 points
2. Peer Teaching Lesson	20 points
3. Science Action Research	15 points
4. Exploratorium Event	15 points
5. Resource Notebook	20 points
6. 3-5 Day Unit Plan	20 points

### Course Grades will be determined by points earned:

A = 93-100	B = 83-86	C = 73-76
A- = 90-92	B- = 80-82	C- = 70-72
B+ = 87-89	C+ = 77-79	D = 60-69

### **An "A" student is one who:**

- completes all assignments on time and demonstrates the ability to summarize, analyze, and/or reflect at high levels.
- varies sources of information for assignments, demonstrating high degree of effort in pursuing varied perspectives around important educational issues.
- completes all the reading assignments and develops thoughtful and thorough responses.
- produces work that reveals a strong commitment to self-discovery and learning.
- produces work at a high professional level in terms of both writing and content.
- develops a high quality presentation, demonstrating significant learning around a contemporary issue.
- presents confidently and intelligently, demonstrating effective teaching skills.
- completes assignments in/out of class with a focus on learning and exploration, pushing him/herself to better understand the profession through quality work.
- attends almost every class meeting and is fully engaged during class.
- pushes him/herself to new understandings by participating in discussions, sharing his/her opinions, and valuing others' perspectives.
- contributes to the positive environment of the class by respecting all members.

### **A "B" student is one who:**

- completes all or almost all assignments, all or most on time, and demonstrates the ability to summarize, analyze, and/or reflect at fairly high levels, showing consistent improvement over time.
- varies sources of information for assignments, demonstrating high degree of effort in pursuing varied perspectives around important educational issues.
- completes all or most of the reading assignments and develops thoughtful and fairly thorough responses.
- produces work that reveals a commitment to self-discovery and learning.
- produces work that is close to professional level in terms of both content and writing, working to develop a strong command of writing, speaking, planning and presenting.
- develops presentations, demonstrating significant learning
- presents confidently and intelligently, demonstrating effective teaching skills.
- completes assignments in/out of class with a focus on learning and exploration, pushing him/herself to better understand the profession through quality work.
- attends almost every class meeting and is regularly engaged during class.
- pushes him/herself to new understandings by participating in discussions, sharing his/her opinions, and valuing others' perspectives.
- contributes to the positive environment of the class by respecting all members.

**A “C” student is one who:**

- completes or attempts most of the assignments, mostly on time, and demonstrates the ability to do some quality summarizing, analysis, and reflection, showing improvement over time.
- varies sources of information for assignments, demonstrating effort in pursuing varied perspectives around important educational issues.
- completes most of the reading assignments and develops thoughtful and sometimes thorough responses.
- produces work that reveals a commitment to some self-discovery and learning.
- produces work that is not yet at a professional level in terms of both writing and content.
- develops a quality presentation, demonstrating learning around a contemporary issue.
- presents confidently and intelligently, demonstrating some effective teaching skills.
- completes assignments in/out of class with a focus on learning and exploration, pushing him/herself a little to better understand the profession.
- attends most class meetings and is often engaged during class.
- pushes him/herself to some new understandings by participating to a moderate degree in discussions, sharing his/her opinions, and valuing others' perspectives.
- contributes to the positive environment of the class by respecting all members.

A “D” student is one who doesn’t meet all of the minimal standards of a “C” student; “F” is earned by someone who hasn’t completed significant portions of the required work and fails to meet the “C” student standards.

## Assignment Schedule

<b>Date</b>	<b>Topic</b>	<b>Readings DUE</b>	<b>Assignments DUE</b>
January 21	<b>Orientation</b> - Course Overview - Discrepant Event - Peer Teaching <b>Frameworks Overview</b>	(In Class) Friedl: CH1, 2	
January 28	<b>Earth Science</b> Exploratorium Planning	Friedl: Ch. 11, 13,14,15, 16	Peer Teaching #1 <b>Resource Notebook</b>
February 4	<b>Physical Science</b>	Friedl: Ch. 3,4,5,6	Peer Teaching #2 Peer Teaching #3
February 11	<b>Physical Science</b>	Friedl: Ch. 7,8,9,10, 11 12	<b>Resource Notebook</b> Peer Teaching #4 Peer Teaching #5
February 18	<b>Life Science</b>	Friedl: Ch. 17, 18,19,20	<b>Action Research Paper</b> Peer Teaching #6 Peer Teaching #7
<i>*Monday</i> <i>February 23</i>	<b>Exploratorium: Water Carousel Thompson M.S.</b>		<b>Resource Notebook</b>
March 3	<b>Unit Plan Presentations</b>		<b>Unit Plan Resource Notebook</b>
March 10	<b>Mock Interviews</b>		