

CALIFORNIA STATE UNIVERSITY SAN MARCOS
COLLEGE OF EDUCATION
EDMS 545B – Science Education in Elementary School
Mondays 1.00 – 3.45 p.m. UH 460

General Information:

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Other times are also available by appointment so please feel free to call or e-mail me to set up a convenient time to meet.

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.

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

Learning from Cases: Unraveling the Complexities of Elementary Science Teaching. By Tippins D. J., Koballa T. R. & Payne B. D. Boston, MA: Allyn & Bacon.

Other handouts may be distributed in class or through WebCT

Other Good Books *A Year of Hands-on Science* (1996). By Lynne Kepler. New York: Scholastic.

Teaching Science as Inquiry. By Arthur Carin & Joel Bass. Columbus OH, Prentice Hall.

200 Goopy, Slippery, Slimy, Weird & Fun Experiments. (1993).
By Janice VanCleave. New York: JohnWiley

Science Matters: Achieving Scientific Literacy. By Robert M. Hazen

Great Explorations in Math & Science (G.E.M.S.). Lawrence Hall of Science.
<http://www.lhs.berkeley.edu/GEMS/>

Activities Integrating Math and Science. Aims Education Foundation.
<http://www.aimsedu.org/aimscatalog/default.tpl>

These and many other hands-on science books are in bookstores, museums, zoos, even grocery stores!

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 team 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 into 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 an elementary science-teaching mini-unit.
10. Practice strategies to include all students in science (linguistically and culturally diverse, students with disabilities and other students with special needs).

INFUSED COMPETENCIES

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))

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

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. 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.

For this class, if you miss 2 classes your highest grade can only be A-. If you miss 3 class sessions or are late (or leave early) for four or more sessions, your highest possible grade is a B. If you miss 4 class sessions, your highest possible grade is a C. If you miss more than 20% of the class (3 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.

Writing

In keeping with the All-University Writing Requirement, all courses must have a writing component of at least 2,500 words (approximately 10 pages), which can be administered in a variety of ways.

Students with Disabilities Requiring Reasonable Accommodations

Students are approved for services through the Disabled Student Services Office (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.

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

TOPICS OUTLINE

The Nature of Science
The Learning Cycle Model of Teaching
Learning Cycle Science Lesson Demonstrations
Writing Objectives for Student Learning
Writing Science Concept Definitions
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. Participation, Collaboration and Professionalism (Individual)	10%
2. Discussion Questions (individual)	10%
3. Reading Leadership on Hand-on science lesson (May work in pairs)	20%
4. Science Fair Exposition (may work in pairs)	15%
5. Science Teaching Unit and Presentation (Capstone Teams)	20%
6. Incidental Assignments and Quizzes	20%
6. Science Teaching Notebook (Individual)	5%

**Late assignments will be penalized by a 10%-point reduction each day they are late.
Keep digital copies of all assignments for your Credential Program Electronic Portfolio.**

CRITERIA FOR GRADING ASSIGNMENTS

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%

Grades will be determined by points earned:

A = 93-100	C+ = 77-79
A- = 90-92	C = 73-76
B+ = 87-89	C- = 70-72
B = 83-86	D = 60-69
B- = 80-82	F = 0-59

ASSIGNMENT DESCRIPTIONS

1. **PARTICIPATION, COLLABORATION AND PROFESSIONALISM (individual) 10% Due on 12/06/04**

Students will engage in active learning each class session, and will be expected to actively participate, collaborate, and demonstrate professionalism at all times.

- Do you participate in class discussions productively, sharing your knowledge and understandings?
- Do you interact productively with your peers, taking on a variety of roles (leader, follower, etc.)?
- Do you contribute appropriately to group work—do you “do your share”?
- Are you able to accept others’ opinions?
- Are you supportive of others’ ideas?
- Do you support your peers during their presentations?
- Can you monitor and adjust your participation to allow for others’ ideas as well as your own to be heard?
- Do you show a positive attitude and disposition towards teaching all students?
- Do you exhibit professional behavior at all times?
- Do you attend each and every class, arrive on time and well prepared in all aspects, and do not ever leave early?
- Do you give close attention to each activity and speaker?

You will do a self assessment using the Rubric for Participation, Collaboration and Professionalism; and write a two-three page rationale. You should give a rationale for the points you gave yourself in each area of the rubric and provide examples for each area. Your professor will also do an assessment using this rubric. Turn in your Rubric and Rationale with examples.

2. **DISCUSSION QUESTIONS: (Based on Readings from Learning from Cases Textbook) 10% Due on the day of class**

Each student will be required to submit a discussion question for the class based on the readings of the assigned chapters from the book *Learning from Cases*. The question should be submitted to the WebCT class postings under the heading identified for discussion questions by noon on the day of the class when such readings are assigned. The specific chapters assigned for each day are shown in the class schedule in the appendices to this syllabus. The discussion question should be an open-ended question that provides opportunity for discussion and calls for diverse responses. In addition it should reflect that you read the assigned readings. The dates when the questions are due are reflected in the course schedule. Examples of such questions will be available on WebCT.

3. **LEADERSHIP OF HANDS-ON SCIENCE LESSONS – Critical Assessment Task (CATs) 20% - Due on assigned day for the lesson**

You will work in groups of two to lead a science lessons based on the Learning Cycle Model of Instruction. You will prepare and teach this lesson to your classmates. Each team will be allocated a maximum of 30 minutes of class time to teach their lesson. Use activities from the textbook, Internet sites or other science resources. The team should teach the lesson as you would to elementary school students.

Each group will be assigned a specific grade level for each you will plan and teach the lesson. This will determine the grade level and California Science Standard your lessons will cover. The group will work together reviewing each other’s lesson ideas, sharing resources, and making sure each member presents a different part of the lesson. Collaboration between group members is essential to divide up the work, and support each other.

Your Hands-On Learning Cycle Science Lesson will have two parts.

Part I. Each team will present one lesson that follows the Learning Cycle lesson format and will emphasize a science concept related to the California Science Standards. The lesson will have at least one hands-on activity, it is 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 science process skills with science manipulatives. Each hands-on activity is required to have predictions made and recorded before beginning the activity. And a data sheet where students can record observations or data collected from the activity. Try to have students make quantitative measurements (length-meters, weight-grams, time), remember to use metric units of measurement.

The Learning Cycle lesson format

- I. Grade Level and California Science Standard the lesson is addressing
- II. Objectives (3-4) (use behavioral objectives with action verbs—i.e., The students will ___)
- III. Two essential questions that the learner should be able to answer after the lesson and background information, what information would a teacher need to teach the lesson, if they didn't have any science background on the particular concept.
- IV. Materials needed for the lesson
- V. Exploration Phase, describe the procedure in detail for conducting the exploration phase of the lesson. What will the teacher and students do, what are possible questions the students will have? (see rubric for details)
- VI. Concept Invention Phase Describe in detail how to teach the concept. (see rubric for details) Include the use of your PowerPoint here.
- VII. Concept Application Phase how will you specifically address this section. If at all possible include another hands on activity. (see rubric for details)
- VIII. SDAIE strategies
- IX. Adaptations for students with disabilities
- X. A 1-2 page summary of the science content background
- XI. A list of 5 relevant web sites (with descriptions)
- XII. Applications to everyday life.

Resources from the Internet are a required part of Concept Invention Phase. Images, movies, simulations, sounds, and other exciting resource are available free over the Internet. Students are responsible for emailing the instructor a PowerPoint presentation for the Concept Invention Phase part of your lesson. The PowerPoint can only be emailed or brought in on a CD. Keep the PowerPoint relatively simple; don't add bells and whistles that take away from the content.

Be sure you understand the concepts you are teaching, and that you can explain them. The lesson should be developmentally appropriate for middle level and should follow the NSTA Safety Guidelines. Make sure that you include the three stages of the Learning Cycle and science content background is addressed.

Part II. Share a description of websites (at least five) used in developing the lessons in your handout to the class. Share any other pertinent information a teacher would need to present the lessons. Also take time to present the detailed textbook content related to the topic beyond what the lesson covers that is relevant for the unit in that topic. You should use PowerPoint for this part.

Each group will prepare a handout that includes the lesson that the team presented, a description of websites used. Bring copies of the activity (for everyone in class) with (a) group members' names at the top.

4. Incidental Assignments and Quizzes – 20%

The quizzes will be given twice. They will be based on the essential questions stated in your hands-on lesson assignments. After about half the lessons have been presented and after the last hands on lesson has been presented, a quiz will be given on the content of the events. The course instructors will design the quiz based on the questions submitted by each partner pair on their hands-on lesson. *These quizzes will be open notebook, but not open handout. That means you should take careful notes during each lesson presentation. Due dates: 10/25/04 & 11/29/04.*

5. SCIENCE FAIR EXPOSITION – Critical Assessment Task (CATs) 15% Due on 11/1/04

Develop an inquiry activity that uses a discrepant event appropriate for elementary students. You may work in teams of 3 on this assignment.

You will prepare a hands-on science lesson and poster about a discrepant event that leads to a science concept. You will present the lesson at our Elementary School Science Fair Exposition. The audience will be 6th grade student at Live Oak Elementary School in Fallbrook. 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 Reflection. The activity should include hands-on tasks and should emphasize particular science concepts. The activity should allow students to explore and then you will explain the concept behind the activity.

On the day of the fair, you will do the activity repeatedly (about 10 times) to teams of about 7 student.

Turn in your typed Lesson Plan with your names at the top and REFERENCES at the bottom.

1. Science Concept (and definition) you are teaching. Write it out in a complete sentence. Do not say “The students will ____.” (That is an objective, not a science concept.)
2. Essential Questions
3. 1-3 Behavioral Objectives
4. California Science Content Standards addressed
5. Exploration Activity
6. Concept Invention
7. Concept Application Activity
8. The Reflection (answer the following):
 - a. How did the children respond? (What did they say and do?)
 - b. How do the children’s actions and responses demonstrate their level of understanding.
 - c. How did you (or can you) improve upon your lesson to facilitate understanding?

6. SCIENCE TEACHING UNIT AND PRESENTATION– Critical Assessment Task (CATs) 20% Due 12/13

(May work in teams assigned to the Research project in ID 381)

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.

The goal of this assignment is for you to think of how you can transform scientific research work that you generate from the Capstone Project into a teachable elementary science unit of instruction. The unit plan will be related to the study you conduct as part of your capstone assignment. Details of this assignment will be shared in class.

7. SCIENCE TEACHING NOTEBOOK (individual) 5% Due 12/6/04

You will keep a class notebook, and will meet with the instructor during the last class period to review contents. Please use section dividers and labels for sections. For some assignments, you may need to make copies in order to include everything in your notebook.

Alternative to the hard copy notebook, you may organize your notebook electronically and submit a CD copy to the instructor on the last day of class. This alternative is not required but highly recommended.

- I. California Science Content Standards for grades K-6 (download from <http://www.cde.ca.gov/board/pdf/science.pdf> and print)
- II. Discussion questions (those submitted by you)
- III. Learning Cycle Lessons presented in class
- V. Science Fair exposition lesson and reflection
- VI. Science Unit Plan and Capstone Project Report
- VII. Other Class Handouts and incidental assignments.

8. Extra Credit (Directors Role):

- Be a director, according to the list below. 5 points
 - Director of Directors – Assigns Directorships – keeps list
 - Syllabus director – holds a hard copy of the Syllabus so other students can make copies.
 - Name Tag Director – Make sure everybody has a name tag each class
 - Contact Information Director—Make class list with current contact info
 - Attendance Director: Maintains attendance sheet and ensures that everybody present in class signs for attendance.
 - Photographer – takes photos of various class activities. Shows them to class.
 - Webmaster – Find science/science ed websites coordinate, WebCT tasks – present to class

RESOURCES

JOURNALS

Science	Science Scope	Physics Teacher
Science and Children	The Science Teacher	Journal of Chemical Education
Science Education	School Science and Math	Innovations in Science & Technology Education
Science News	American Biology Teacher	Journal of Research in Science Teaching

Tentative Class Schedule

Class #	Date	Topic
1	8/30	Course Overview: What is Science? The Nature of Science and Inquiry Process in Science Review Syllabus Sign up for Leadership of Science Activities <i>Bring Syllabus to class</i>
2	9/13	Teaching Tips: Constructing Knowledge and Discovering Meaning via the Learning Cycle <i>Read The Learning Cycle Handout on WebCT</i> Discussion Question Due
3	9/20	Teaching Tips: Inquiry Processes in Science <i>Read Cases 2.1 & 5.4 from Learning from Cases text.</i> Question Due
4	9/27	Teaching Tips: Planning and Managing Inquiry based Lessons <i>Read Cases 3.3, 4.4 & 6.1 from Learning from Cases text.</i> Question Due
5	10/4	Teaching Tips: Using Cooperative strategies & questioning and Wait time as a Learning tools <i>Read Cases 2.3 & 3.2 from Learning from Cases text.</i> <i>Learning Cycle Lesson Presentations</i> Questions Due
6	10/11	Problem-based learning & Unit Planning <i>Read Cases 2.2 & 4.1 from Learning from Cases text.</i> Questions Due <i>Learning Cycle Lesson Presentations</i>
7	10/18	Teaching Tips: Assessment of Understanding and Inquiry <i>Read the entire Chapter 7 from Learning from Cases text.</i> <i>Learning Cycle Lesson Presentations</i> Question Due
8	10/25	Teaching Tip: Integrating Science with other subjects <i>Read Cases 6.2 & 6.3 from Learning from Cases text.</i> Question Due Science Exploratorium Lesson Due <i>Learning Cycle Lesson Presentations</i>
9	11/1	Science Fair Exposition Day; Live Oak Elementary School- Fallbrook
10	11/08	Teaching Tips: Adapting Science curriculum for children with Special Needs <i>Read Cases 5.1, 5.2, 5.3 & 8.1 from Learning from Cases text</i> Question Due <i>Learning Cycle Lesson Presentations</i>
11	11/15	Teaching Tips: Science WebQuests <i>Read Cases 4.2, 8.2 & 9.4 from Learning from Cases text</i> Question Due <i>Learning Cycle Lesson Presentations</i>
12	11/22	Teaching Tips: Science Projects, Student Research, Science Fairs and Science Safety <i>Read Cases 9.1, 9.2, & 9.3 from learning from Cases text</i> <i>Learning Cycle Lesson Presentations</i> Question Due

13	12/29	Teaching Tips: Teaching for Understanding & Professional Development for Elementary Science Teachers <i>Read Chapter 10 of Learning from Cases text.</i> <i>Learning Cycle Lesson Presentations</i> Question Due
14	12/6	Teaching Tips: State Approved Textbooks Contemporary Issues in Science Education <i>Read Cases 6.4 & 8.3 from Learning from Cases text</i> Question Due Unit Plans Due PCP Rubric Due Notebook Due
15	TBA	Research Project & Unit Plan Presentations

SCIENCE METHODS GRADESHEET

<u>Assignments</u>	<u>Percent of Grade</u>	<u>Your Grade</u>	<u>Points for Final Grade</u>
1. Participation, Collaboration, Professionalism	10%	_____	x 0.10 = _____
2. Discussion Questions	10%	_____	x 0.10 = _____
3. Leadership of Hands-on Science Lessons	20%	_____	x 0.20 = _____
4. Conceptual Quizzes	20%	_____	x 0.20 = _____
5. Science Fair Exposition	15%	_____	x 0.15 = _____
6. Science Teaching Unit and Presentation	20%	_____	x 0.20 = _____
7. Science Teaching Notebook	5%	_____	x 0.05 = _____

FINAL GRADE = _____

- A = 4.00**
- A- = 3.67**
- B+ = 3.33**
- B = 3.00**
- B- = 2.67**
- C+ = 2.33**
- C = 2.00**
- ETC**