

California State University San Marcos
College of Education
EDMS 545 - Elementary Science Education
CRN#41605
M-R 7-9:45

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Required Textbooks:

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

EDMS 545 Elementary Science Methods. Dave Reynolds

Other Good Books:

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

Great Explorations in Math & Science (G.E.M.S.) Booklets over 36 to choose from
Any Selection will match a CA Science Standard <http://www.lhs.berkeley.edu/GEMS/>

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

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

These are in the bookstore, but there are many excellent hands-on science books. Look in bookstores, museums, teacher stores, 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 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 on-going service. Our practices demonstrate a commitment to student-centered education, diversity, collaboration, professionalism, and shared governance.

INFUSED COMPETENCIES

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.

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.

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.

COURSE REQUIREMENTS

Attendance Policy

Due to the dynamic and interactive nature of course in the COE, 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. **If two class sessions are missed, or if the student is late (or leaves early) more than three sessions, s/he cannot receive a grade of "A".** If three class sessions are missed, the highest possible grade that can be earned is a "C+". If extenuating circumstances occur, the student should contact the instructor as soon as possible to make appropriate arrangements. 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.

Course Outline

Class #	Date	Topic	Assignment Due
1	Sept. 5	Course Overview: Why Science? The Learning Cycle Model of Teaching Review Syllabus Sign up for Groups-Leadership of Science Activities	
2	Sept. 9	Teaching Tips CA Science Content Standards Grades K-8 Teaching Science in Inclusive Classrooms Writing Objectives Using CA Science Standards <u>Learning Cycle Science Lesson: Matter</u>	Ch. 1 Reading Response
3	Sept. 12	Meet in computer lab room UH 272 Teaching Tips Using Internet Resources in Presentations Writing Objectives and Explanations of Science Concepts.	Ch. 2 Reading Response

4	Sept. 16 Teaching Tips Exemplary Science Materials Beginning to Teach Science/SDAIE Strategies in Science <u>Learning Cycle Science Lesson: GEMS</u>	Ch. 3 Reading Response
5	Sept. 19 Meet in computer lab room UH 272 Teaching Tips Science Resources via the Internet <u>Learning Cycle Science Lesson: Group 1-Magnetism & Static Electricity</u>	Ch. 5 & 6 Reading Responses
6	Sept. 23 Teaching Tips Infusing Writing Activities in Science Lessons <u>Learning Cycle Science Lesson: Group 2-Sound</u>	Ch. 8 Reading Response
7	Sept. 26 Teaching Tips Authentic Assessment <u>Learning Cycle Science Lesson: Group 3-Light, Color, Lenses</u>	Ch. 9 Reading Response
8	Sept. 30 Teaching Tips Unit Planning <u>Learning Cycle Science Lesson: Group 4-Air and Air Pressure</u> <u>Learning Cycle Science Lesson: Group 5-Weather/Climate</u>	Ch. 10 & 11 Reading Response
9	Oct. 3 Field experience for Science Practicum & Case Study	
10	Oct. 7 Teaching Tips Science Process Skills <u>Learning Cycle Science Lesson: Group 1-Space Science/Sun, Moon, and Stars</u>	Ch. 14 Reading Response
11	Oct. 10 Teaching Tips Authentic Assessments in Science <u>Learning Cycle Science Lesson: Group 2-Geology</u>	Ch. 15 Reading Response
12	Oct. 14 Teaching Tips Biological Descriptions of Disabilities <u>Learning Cycle Science Lesson: Group 3- Plants</u>	Ch. 17 Reading Response Case Study Due
13	Oct. 17 Teaching Tips Science Projects, Student Research, Science Fairs and Science Safety <u>Learning Cycle Science Lesson: Group 4- Animals</u>	Ch. 18 Reading Responses
14	Oct. 21 Teaching Tips State Approved Textbooks CA State Frameworks <u>Learning Cycle Science Lesson: Group 5- Nutrition/Fitness</u>	Ch. 19 Reading Response Science Practicum Due
15	Oct. 24 Unit Presentations	Science Unit Plan Due

COURSE ASSIGNMENTS

1. Reading Responses	18%
2. Teaching Tip	2%
3. Science Instruction Case Study	20%
4. Leadership of Hands-on Science Lessons	20%
5. Science Practicum with School Age Children	20%
6. Science Teaching Unit with Learning Cycle Lessons	20%

PRIMARY TEACHING PERFORMANCE EXPECTATIONS

- TPE 1A: Subject-Specific Pedagogical Skills for Multiple Subject Teaching Assignments
- TPE 4: Making Content Accessible
- TPE 5: Student Engagement

TPE 6: Developmentally Appropriate Teaching Practices
TPE 6A: Developmentally Appropriate Practices in Grades K-3
TPE 6B: Developmentally Appropriate Practices in Grades 4-8

PRIMARY TEACHING PERFORMANCE EXPECTATIONS

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

TPE 2: Monitoring Student Learning During Instruction

TPE 6: Developmentally Appropriate Teaching Practices

TPE 6A: Developmentally Appropriate Practices in Grades K-3

TPE 6B: Developmentally Appropriate Practices in Grades 4-8

TPE 10: Instructional Time

TPE 11: Social Environment

SECONDARY TEACHING PERFORMANCE EXPECTATION

TPE 8: Learning about Students

ASSIGNMENT DESCRIPTIONS

1. READING RESPONSES

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

- a. A Big Ideas paper explaining the key science concepts.
- 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. They may be typed or handwritten, but must be legible. They will be checked off for completion each due date, noted in the course outline. Representative samples will be examined for closer reading.

Key skills/knowledge:

For Ch. 1-2, summarize the information.

Beginning with Ch. 3 write about the science content, **not the activities**. You are excused from turning in reading responses for chapters you are presenting in class.

2. Teaching Tip

Each student share a tip on teaching strategies for science or managing the classroom. You will be assigned dates for your short presentation (3-4 minutes).

3. SCIENCE INSTRUCTION CASE STUDY

In this assignment you will develop a case study of science instruction. It consists of four parts:

- I. Your observations of the classroom.
- II. Teacher Interview.
- III. Student Interviews.
- IV. An analysis of your interviews and observations.

When writing up the case study, **do not include the teachers, or a student names**, but do identify the grade level of the students. Report all answers to questions in the following format; write out the question then the response, either your observations or answers to questions of the six students and teacher.

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

I. Classroom Observation Questions

- 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) How is the classroom organized for science instruction?
- 7) What science materials are in the classroom?
- 8) Do you see writing infused within the science lessons? If so, what are some examples?
- 9) Are there children in the class who are learning English? What differences and similarities exist for children who are learning English?
- 10) Feel free to add more descriptive information in regard to science instruction.

II. Teacher Interview Questions

After you have observed the class interview the teacher in person (do not give them the questions to answer), a personal interview allows you to ask follow up questions to clarify answers.

- 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.

III. Student Survey

Ask the teacher if you can hand out the Science Survey to **six** 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 six 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). Be flexible and adapt the survey to the level of the students. Interview each student using the survey questions. Record the answers, if possible, and transcribe the taped interviews. To report out the data, write the question then six students responses to the question.

Student Survey Questions

Please answer the following questions.

Grade level: _____ Are you a Boy ρ Girl ρ ?

What language(s) do you speak? English ρ Spanish ρ Other ρ

- 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?

IV. An analysis of your interviews and observations.

Examine the three sets of data (your responses, those of the teacher and students) for matches and mismatches. You might want to make a grid to organize the data:

Data Analysis Chart

	Me	Teacher	Students
How is science taught?			
How does the teacher teach science?			
How often do the students participate in hands-on science activities?			
What Adaptations and Accommodations are present			

Use whatever categories or questions that seems relevant in the left-hand column in order that you may compare and contrast the three points of view regarding science instruction

Analysis of Information—The paper you will write

Using the data you have collected and the match/mismatch chart and type a 2-3-page case study of the science instruction. Compare your observations, the teacher interview and student responses and report out the matches or mismatches between groups. Turn in your case study along with six surveys, teacher interview and your classroom observations. Include a kudos or recommendation section. Describe good science teaching practices you observed and make recommendations that you think could help the teacher improve his or her science instruction.

4. LEADERSHIP OF HANDS-ON SCIENCE LESSONS (TWO GROUP LESSONS)

You will work in-groups of **three or four** to lead science lessons based on the Learning Cycle Model of Instruction. You will teach these to your classmates. Each lesson will be allocated a maximum of forty minutes of class time to teach. The class will not role-play elementary students, but will learn the science content and how to teach the lesson. Treat your classmates as teachers, not elementary students.

Your lesson will have two parts. Part I. The class following your lead of the hands-on lesson. During the lesson you will present your PowerPoint presentation during the Concept Invention phase. Part II Share SDAIE strategies used, books, and other resources or information teachers would find helpful in presenting the lesson.

Part I. The lessons will follow the Learning Cycle lesson planning and include two hands-on activities, and will emphasize particular science concepts related to the California Science Standards. The Exploration and Application phases of the Learning Cycle 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. 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.

Resources from the Internet are also a required part of your lesson. 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. Include all URLs used in developing the lesson in your handout to the class.

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 three stages of the Learning Cycle and science content background is addressed.

Part II. Discuss applications to everyday life, that may not of been discussed in the Application Phase of the learning cycle. Describe SDAIE strategies used with this lesson to meet the learning needs of children whose first language is not English and list them in your handout. Share examples of age appropriate children's books that could be used to support the students understanding of the concepts. Public libraries are excellent resources for obtaining books. Share any other pertinent information a teacher would need to present the lesson.

Each group will prepare a handout that includes the lesson, a summary of the science content background, SDAIE strategies, and applications to everyday life. A list of children's books and URLs used. 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 California Science Standard and grade level you are teaching.

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

PRIMARY TEACHING PERFORMANCE EXPECTATIONS

TPE 1A: Subject-Specific Pedagogical Skills for Multiple Subject Teaching Assignments

TPE 2: Monitoring Student Learning During Instruction

TPE 4: Making Content Accessible

TPE 5: Student Engagement

TPE 6: Developmentally Appropriate Teaching Practices

TPE 6A: Developmentally Appropriate Practices in Grades K-3

TPE 6B: Developmentally Appropriate Practices in Grades 4-8

TPE 9: Instructional Planning

TPE 10: Instructional Time

TPE 13: Professional Growth

SECONDARY TEACHING PERFORMANCE EXPECTATION

TPE 7: Teaching English Learners

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

Develop an inquiry activity using the learning cycle to teach to elementary students. You will either teach to a whole class, a small group(s) of students or any small group of children (3-4). For this assignment, you must turn in a copy of your Lesson and your Reflection.

The Reflection should include:

1. How did the children respond? (What did they say and do?)
2. How do the children's actions and responses demonstrate their level of understanding?
3. How did you (or can you) improve upon your lesson to facilitate understanding?
4. How could you accommodate special needs of students?
5. How would you change the lesson before presenting it to a large group of students?

You will prepare a hands-on science activity to match a California Science Standard. 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.

The lesson will include hands-on lessons, and emphasize a California Science Standard. The Exploration and Application phases of the Learning Cycle require different hands-on science activities using manipulative. 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 manipulative. Have students make predictions before the activity and collect observations or data. Try to have students make quantitative measurements (length-meters, weight-grams, time), remember to use metric units of measurement.

PRIMARY TEACHING PERFORMANCE EXPECTATIONS

TPE 1A: Subject-Specific Pedagogical Skills for Multiple Subject Teaching Assignments

Teaching Science in a Multiple Subject Assignment

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TPE 6: Developmentally Appropriate Teaching Practices

TPE 6A: Developmentally Appropriate Practices in Grades K-3

TPE 6B: Developmentally Appropriate Practices in Grades 4-8

TPE 13: Professional Growth

SECONDARY TEACHING PERFORMANCE EXPECTATION

TPE 8: Learning about Students

TPE 12: Professional, Legal, and Ethical Obligations

5. SCIENCE TEACHING UNIT

You will create a unit on a specific science topic and Science Standard. You may work in-groups of up to three people. You may bring a stamped, self-addressed manila envelope in order to receive graded unit back before the next semester. You may use lessons from Leadership of Hands-on Science lessons.

1. Unit Plan (1 page-include title, grade level, California Science Standard addressed, goals for unit, one-two line descriptions of each lesson)
2. One Learning Cycle Lesson Plan from each group member. It can be a lesson you presented in Leadership of Hands-On Science Lessons
For each lesson, include the following:
 - a. Topic
 - b. Science Standard or Substandard Grade Level--Write out the Standard(s)
 - c. Objectives (1-2) (use behavioral objectives with action verbs—i.e., The students will ___)
 - d. Exploration Activity- Describe the activity in detail, what materials are required and explain what students and teacher will do. Students have to make predictions, then record observations or data during the activity. Lesson needs to be very specific.
 - e. Concept Invention Activity --explain what students will do and what teacher will do. Include the science concept background information a teacher would need to discuss the exploration activity with the students. Explain what happened during the Exploration phase.
 - f. Concept Application Activity- Describe the activity in detail, what materials are required and explain what students and teacher will do. Students have to record observations or data. Lesson needs to be very specific. Describe the applications of the science concept you just taught.

For sections d-f make sure you write out specific instructions, someone should be able to teach from your lesson.

The lessons should include hands-on lessons, and should emphasize particular science concepts that connect to a specific California Science Standard. The Exploration and Application phases of the Learning Cycle must require different hands-on science activities using manipulative. 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 manipulative.

Each Person in-group will include the following after their lesson.

3. SDAIE Strategies –explanation of SDAIE strategies included and how they are used
4. Science Process Skills – explanation of science process skills used and how they’re used. Examples are students will make predictions, record data or observations. Look at the Experimentation and Investigation section of the California Science Standards for ideas.
5. One alternative assessments for the Unit, describe the standard the students will be tested on; include a scoring rubric.

Each Group will include after the lessons one example of the following

6. Description of an Activity Center to go with Unit.
7. List examples of age appropriate children’s books that could be used to support the students understanding of the concepts.
8. List resources from the Internet. Images, movies, simulations, sounds, and other exciting resources used to support the students understanding of the concepts
9. Description of Final Project for Unit. This is a culminating activity, how will the students either extend their learning or show mastery of the Standard. It could be a presentation to parents, other classes, or a field trip.
10. References

PRIMARY TEACHING PERFORMANCE EXPECTATIONS

TPE 1A:Subject-Specific Pedagogical Skills for Multiple Subject Teaching Assignments

Teaching Reading-Language Arts in a Multiple Subject Assignment

Teaching Science in a Multiple Subject Assignment

TPE 4: Making Content Accessible

TPE 5: Student Engagement

TPE 6: Developmentally Appropriate Teaching Practices

TPE 6A: Developmentally Appropriate Practices in Grades K-3

TPE 6B: Developmentally Appropriate Practices in Grades 4-8

TPE 9: Instructional Planning

TPE 10: Instructional Time

TPE 13: Professional Growth

SECONDARY TEACHING PERFORMANCE EXPECTATION

TPE 3: Interpretation and Use of Assessments

TPE 7: Teaching English Learner