

CALIFORNIA STATE UNIVERSITY SAN MARCOS
COLLEGE OF EDUCATION
EDMS 545 – Elementary Science Education
Summer 2010 – Meeting Time: Mondays & Wednesdays 6.00 – 10.10 p.m.
University Hall 460

General Information:

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Office Hours: Before and after class. Other times are also available by appointment so please feel free to call or email 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:

- Friedl, A.E. & Koontz, T.Y. (2005). *Teaching Science to Children. An Inquiry Approach, 6th Ed.* NY: McGraw-Hill.
- California Department of Education (2003). *Science Framework for California Public Schools.* Sacramento, CA: CDE. [Also available online.](#)

Other handouts will be distributed in class or through WebCT

Other Recommended Books

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 focuses on developing an understanding of theory, methodology, and assessment of science in integrated and inclusive elementary and middle level classrooms. *This course is aligned with California's SB 2042 Standards* and it is designed to provide a comprehensive overview of the objectives, skills, concepts, experiments, materials, and methods necessary to teach science to elementary and middle 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 Prerequisites:

Admission to a Multiple Subject/CLAD Teacher Credential Program.

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 and Middle 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 and middle school 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 integrated 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 candidates to use technologies, emphasizing their use in both teaching practice and student learning.

Computer Use During Class

You are welcome to use a laptop computer in class when working on class assignments, for example. However, you will need to save checking email or other personal computer use for time outside of class. Most students find it disruptive when they are focusing on class activities or listening to presentations and can hear keyboarding in the classroom. Your kind consideration is greatly appreciated by all!

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. 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, each class session that you are absent from class drops your maximum final grade by 5% points. Late arrivals and early departures will affect your final grade as well. For each late arrival or early departure you will lose 2% points. A make-up assignment will be available for up to two classes (10% points). This means that if you are absent twice and complete a make up assignment and earn full credit points on this assignment, you may not be penalized on attendance. The makeup assignment applies to ALL absences excused or otherwise. Absences do not change assignment due dates.

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.

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.” In addition, all cases of academic dishonesty will be reported to the Dean of Students.

Plagiarism

As an educator, it is expected that each student will do his/her own work, and contribute equally to group projects and processes. Plagiarism or cheating is unacceptable under any circumstances. If you are in doubt about whether your work is paraphrased or plagiarized see the Plagiarism Prevention for Students website <http://library.csusm.edu/plagiarism/index.html>. If there are questions about academic honesty, please consult the University catalog.

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 AND LEARNING OUTCOMES

1. Class Participation (Individually Assigned) - 10%
2. Reading Accountability Journal Entries (CONCEPT MAPS) (Individually Assigned) - 30%
3. Hands-on Science Lesson Plan (In Groups, sizes TBD) - 10%
4. Hands-on Science Lesson Presentation (In groups with individual points) – 20 points
5. Hands-on Science Lesson Reflection (Individually Assigned)– 10%
6. Technology & Web Resources for Science Teaching and Learning (Individually Assigned) 20%
7. Make Up Assignment – Up to 10% points for missed classes (Optional & Individually)

Each student is responsible for ensuring that assignments are submitted correctly and on time. Late assignments will be penalized by a 10% point reduction each day they are late. Online assignments not correctly posted do not count as submitted and will be subjected to the late assignment policy. Keep digital copies of all assignments for your Credential Program TPE Portfolio where necessary.

CRITERIA FOR GRADING ASSIGNMENTS

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

The above criteria will be applied in conjunction with specific assignment rubrics

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. Active Participation and Collaboration: 10%

Teacher education is a professional preparation program and students will be expected to adhere to standards of dependability, professionalism, and academic honesty.

Grading will include a component of “professional demeanor.” Students will conduct themselves in ways that are generally expected of those who are entering the education profession, including the following:

- On-time arrival to all class sessions and attendance for the entire class period
- Advance preparation of readings and timely submission of assignments
- A positive attitude at all times
- Active participation in all class discussions and activities
- Respectful interactions with the instructor and other students in all settings
- Carefully considered, culturally aware approaches to solution-finding

Class Discussions and Participation: Students will engage in active learning each class session, and will be expected to actively participate. You may lose points for lack of participation based on the following criteria:

- 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?

2. Concept Maps – 30% points - See class schedule for due dates

Assigned readings from the course text provide an important foundation for your increasing understanding of science content and how to effectively teach science. Three or four chapters from the course text *Teaching Science to Science: An Inquiry Approach*, will be designated for reading on specific class meeting (see class schedule for chapter assignment). To demonstrate your comprehension of the readings, and assist you with meaningful class participation, you are asked to respond to specific the science content-related reading assignments by completing a reading accountability journal entry in the form of a Concept Map. The concept map will be due at the beginning of class time on the dates corresponding to the date the readings are assigned. You will only receive credit points if the concept map is completed by the start of class on date indicated in the schedule.

You will choose one of these chapters and read it to develop an in-depth understanding of its contents. For the chosen chapter, you will prepare a concept map (that has 15-25 concepts with linking words), using correct **concept mapping procedures**. The concept maps should be generated using a concept mapping software of your choice. Some recommended software include; Inspiration (Available on all public university student computers and at www.inspiration.com) or Cmap Tools (free download available at http://cmap.ihmc.us/download/dlp_CmapTools.php?myPlat=Win). You must print and bring a copy of your concept map to class. Put your name, chapter and date when the reading was assigned at the top of each page. You will be asked to share your concept maps with your peers at the beginning of each class session. You should be prepared to share in depth the breadth of your concepts presented in the chapter you read. Individuals will be called on randomly to share their concept maps in class. You will automatically lose half the points on the day’s concept map if you are unable to share the concepts with the class.

Each concept map has a possible total of 5 points based on the following criteria:

- a) Map shows clear hierarchy or relationship

- b) The Map includes at least 15 concepts
- c) Maps cover the depth of the science content in the assigned chapter
- d) Maps use 1-2 words or nouns for Concepts (not sentences)
- e) Maps use verbs or prepositions for linking words between concepts

3. Hands-on Science Lesson Plan –10 Points - See class schedule for due dates

The spirit of the assignment is to develop and teach a particular kind of a science inquiry lesson that teaches both science process skills and science content using the learning cycle instructional model.

You will work in groups of three to create and lead a science lesson based on the Learning Cycle Model of Instruction. You will prepare and teach this lesson to your classmates. Use activities from the textbook, Internet sites or other science resources. The team should teach the lesson as you would to elementary or middle school students.

Each group will be assigned a specific grade level for which you will plan and teach the lesson. This will determine the grade level and California Science Standards 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.

The lessons should include hands-on activities that emphasize specific science process skills and specific science concepts. The Exploration and Application phases of the Learning Cycle require different hands-on science activities and manipulatives. Hands-on activities are NOT reading or completing worksheets (though they may require students to read something or complete lab observation sheets).

Your lesson plan should also identify and explain Strategies for English language learners and adaptations for students with special needs and adaptations for GATE students.

Elements to Include Within Your Lesson Plan

Lesson Title: What is the title of your lesson?

Grade Level: What is the grade level?

Student Groupings: How will you group students for instruction?

California Science Content Standard(s): What standards are addressed? Include at least 1 science area (life science, physical science, or earth science) standard and 1 investigation standard.

Lesson Objective(s)/Outcome: 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 demonstrate understanding of _____.”

Science Concept(s) (Enduring Understandings): What are you trying to teach? Do not say “The students will ____.” (That is an objective, not a concept.)

Essential Question(s): List at least two essential questions specific to the concept that you want students to be able to answer during the lesson. What is it that students should be able to answer by having successfully participated in your lesson? Use high level questions and ensure that these are not lower level fact or information questions (refer to [Bloom’s Taxonomy](#)). For example, instead of “Why did warming the bottle cause the attached balloon to inflate? ask “How can you demonstrate that air is a real substance that occupies space?”

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(s)? What evidence demonstrates that they have achieved the objective?

Criteria for Assessment: What criteria will you use to grade the assessment? How will you know if someone has successfully completed the assessment?

Lesson Procedures: Explain the procedures for each phase of the Learning Cycle. Include what the teacher will do and what the students will do:

The Learning Cycle

a. Exploration (Begin with students making predictions; then have a hands-on SCIENCE activity.)

b. Concept Invention (Make sure students share and discuss data and ideas in the first part of this stage; then the teacher introduces new terms and provides further explanations.)

c. Concept Application (Should be a 2nd hands-on SCIENCE activity.)

Web Sites: 3 interactive relevant web sites with descriptions

Adaptations and accommodations for students with special needs (ELL, Special Education and GATE students)

References: Title, author, publisher, year

Rubric for Hands-on Science Lesson Plan

Your names: _____

Grade Level: _____

| | Score | Comments |
|---|--------------|-----------------|
| Lesson Plan Title (Descriptive) - 1/2 pt. | | |
| Lesson Plan Timeline in periods/ minutes - 1/2 pt. | | |
| Complete Content & Invest/Exper Standards - 1/2 pt. | | |
| Enduring Understanding (Science Concept) – 1/2 pt. | | |
| Essential Questions – 1/2 pt | | |
| Desired Outcomes (learning Objective) 1/2 pt. | | |
| Assessment Description - 1/2 pt. | | |
| Rubric for Assessment listing criteria – 1/2 pt. | | |
| Lesson Introduction - Student Engagement - 1 pt | | |
| Description of Exploration activity – 1 pt | | |
| Description of the key concepts and how you will introduce them - 1 pt | | |
| Description of Concept Application Activity - 1 pt | | |
| Web Sites: 3 interactive relevant web sites with descriptions – 1 pt | | |
| Adaptations and accommodations for students with special needs (ELL, Special Education and GATE | | |

| | | |
|------------------|--|--|
| students) – 1 pt | | |
| TOTAL POINTS/10 | | |

4. Hands-on Science Lesson Presentation – 20 points (See Appendix B for the assignment rubric) See class schedule for due dates

Each team will be allocated a maximum of 30 minutes of class time to teach their lesson. Prepare a PowerPoint 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. Include a list of websites (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.

Begin Exploration with students making predictions or answering essential questions or completing a challenge. You should take the activities “off the paper” and require students to use the science process skills with science manipulatives. **You need to know and demonstrate the stages of the Learning Cycle, or you will not be given credit for your lesson.** Be sure you understand the concepts you are emphasizing, and that you can explain them. The lessons should be developmentally appropriate for K-8 grade students, and should follow the NSTA Safety Guidelines.

Bring one copy of your lesson plan to class for the instructor on the day of your presentation and post a copy of the lesson plan on the online forum of the Cougar Courses page for access by your classmates.

**5. Hands-on Learning Cycle Lesson Reflection – 10% points
Due one week from the date of your presentation**

After teaching the lesson in class, you should each complete a lesson reflection. The reflection should include strengths, weaknesses, and recommendations for improvement addressing the following questions:

- Why were the instructional strategies and student activities appropriate for this class based on learning objectives and student development needs?
- How did the instructional strategies and activities address the development need of these students?
- How did the instructional strategies and student activities help the students make progress toward achieving the state adopted academic content standards for student in this content area?
- Explain the strengths and weaknesses of your assessment in relationship to the learning goals/objectives. Describe your alternative assessment based on the potential gaps in the students learning.

**No longer than 2 pages*

6. Technology & Web Resources for Science Teaching and Learning – 20 points See class schedule for due dates

Technology provides unique resources for teaching and learning in science. In this assignment, you will apply your understanding of web-based resources to specific science lessons.

Procedures to follow:

- a. Read Chapter 3 in the Friedl Text.
- b. You will integrate technology in your hands-on science lesson by providing **opportunities for your students to use technology to access the content and/or skills of the lesson.** In your lesson plan create a category called “Integration of Technology”:

1. Describe in full detail the integration of student use of technology in your lesson. What technology are you integrating in your lesson relative to science content and your learning objectives?

2. Describe in full detail how you will organize and manage the technology and the learning environment so that all students can use the technology by responding to the following questions:

- i. What do you want the students to learn or be able to do by using your planned technology?
- ii. What will the students do? Describe the task that you will assign to students. This may be framed as a “challenge” task.
- iii. What forms of products (student work) will the students generate from the technology experience?
- iv. Describe how you will assess whether or not your students reached the learning objectives, and whether or not the technology you planned helped them reach the learning objectives.

Student use of technology may include:

- a) PowerPoint presentations by students.
- b) Interactive websites you select for students to use. (Note: you must provide 3 examples of interactive websites connected to your lesson content and learning objectives.)
- c) Inspiration or Kidspiration for concept mapping.
- d) Kidpix in which students graphically represent their learning.
- e) Students using video technology.
- f) Students using digital cameras.
- g) A filamentality hot list.
- h) Interactive templates accessed online for teacher-created science games, for students to access at computers.
- i) Another idea of your own choosing for technology integration.

7. Make-up Assignment – 10% points make up for missed class or late arrivals/early departures

By completing this assignment you have the opportunity to offset penalty points for missing one entire class or a combination of up to three late arrivals and/or early departures. Attend a science related informal site or formal event or presentation equivalent in time and effort to one class session (3 hrs). This could be a field trip, museum, lecture or some other equivalent experience that will assist you either directly or indirectly in becoming a science teacher. Your choice!! To complete this requirement: 1) complete a one-page summary with applications to teaching; 2) send by email to all of us; 3) do a 5 minute PowerPoint presentation to the class during class one of the classes. Discuss with the instructor about the class time in which you may do the presentation. The report and oral presentation should include a summary of what science you learned and implications for your own teaching.

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 |

APENDIX A: Tentative Class Schedule

| Class | Date | Topic | Readings & Work Due |
|-------|------|--|--|
| 1 | 6/02 | Course Overview The Nature of Science and Inquiry Process in Science How do we make decisions about what to teach and how we teach it? | Bring Syllabus to class - <i>Read Chapter 1 of Teaching Science to Children</i> |
| 2 | 6/07 | What are the overarching themes that we want our students to learn in science? -Focus on standards and Frameworks -Focus on sequencing instruction – Instructor-Lead Hands-on Activity | - <i>Read Chapter 2 of Teaching Science to Children</i> - <i>Read the CA Science Framework pgs 1-32</i> -Bring Science Education Standards to Class |
| 3 | 6/09 | -Using the Learning Cycle to teach science as inquiry – Instructor-Lead Hands-on Activity | - <i>Read Learning Cycle Handout and bring a copy to class</i> - <i>Read Chapter 4 or 5 or 6 of Teaching Science to Children</i> - CONCEPT MAP #1 on one of Ch. 4, 5, 6 due |
| 4 | 6/14 | - What shall we use as the best indicators that students have learned and understand the intended outcomes? -Focus on Assessment Adapting Science curriculum for children with Special Needs | ONLINE CLASS Draft Lesson Plan Due at end of class |
| 5 | 6/16 | How shall we sequence the learning activities so that students can learn the intended themes? – Lesson Planning – Instructor-lead Hands-on Activity | - <i>Read Chapter 7 or 8 or 9 of Teaching Science to Children</i> - CONCEPT MAP #2 on one of Ch. 7, 8, 9 due |
| 6 | 6/21 | What Activities of Teaching shall we use to make the content accessible to ALL students? -Hands-on Lessons Presentations | - <i>Read Chapter 10 or 11 or 12 of Teaching Science to Children</i> - CONCEPT MAP #3 on one of Ch. 10, 11, 12 due - hands-on Lesson Plans Due - Hands-on lesson Presentations x 3 |
| 7 | 6/23 | What Activities of Teaching shall we use to make the content accessible to ALL students? -Hands-on Lessons Presentations | <i>Read Chapter 13 or 14 or 15 of Teaching Science to Children</i> - CONCEPT MAP #5 on one of Ch. 13, 14, 15 due - Hands-on lesson Presentations x4 |
| 8 | 6/28 | What strategies can use to ensure participations of ALL students in science learning? -Hands-on Lessons Presentations | - <i>Read Chapter 16 or 17 or 18 of Teaching Science to Children</i> - CONCEPT MAP #5 on one of Ch. 16, 17, 18 due - Hands-on lesson Presentations x 3 - hands-on Lesson Reflection Due from 1st presenters |
| 9 | 6/30 | Safety Guidelines for Science Classrooms Units Planning & Integrating Science with other subjects Curriculum Plan Sharing | - <i>Read Chapter 19 or 20 or 21 of Teaching Science to Children</i> - CONCEPT MAP #6 on one of Ch. 19, 20, 21 due - hands-on Lesson Reflection Due from 2nd presenters |
| 10 | 7/05 | Developing Science Web Quests & Technology for science Teaching | ONLINE CLASS <i>Read Chapter 3 of Teaching Science to</i> |

| | | | |
|----|------|---------------|---|
| | | | <i>Children</i> -Web Resources Assignment Due --hands-on Lesson Reflection Due from 3rd presenters |
| 11 | 7/07 | Make-up Class | |
| | | | |

** Tasks in bold will be graded and account directly to course grade

Appendix B

RUBRIC FOR HANDS-ON SCIENCE LESSON PRESENTATION