

**CALIFORNIA STATE UNIVERSITY SAN MARCOS**  
**COLLEGE OF EDUCATION**  
**EDMS 545 – Elementary Science Education**  
**Fall 2009 – Meeting Time: Wednesdays 7.30 a.m. – 2.15 p.m.**  
**University Hall 444**

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, 6<sup>th</sup> 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 10% 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 assignment will be available only for one missed class (10% points). This means that if you are absent once and complete a make up assignment and earn full credit 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) - 10%
2. Reading Accountability Journal Entries (CONCEPT MAPS) (Individually) - 20%
3. Hands-on Science Lesson Plan and Presentation (In Groups, sizes TBD) - 20%
4. Hands-on Science Lesson Reflection (Individually)– 10%
5. Science Fair Exploratorium Lesson & Presentation (Groups sizes TBD) – 20%
6. Web Resources for Science Teaching and Learning (Individually) 20%
7. Make Up Assignment – Up to 10% points for a missed class (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. WebCT 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 Electronic Portfolio where necessary, and for your science notebook. You will not be assigned a course grade unless all required assignments are turned in.

## 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. Reading Accountability Journal Entries (RAJEs or Concept Maps) – 20% 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. To demonstrate your comprehension of the readings, and assist you with meaningful class participation, you are asked to respond to the reading assignments by completing a Reading Accountability Journal Entry (RAJE) in the form of a Concept Map. The concept map will be due at the beginning of class time on the assigned dates. You will only receive credit points if the concept map is completed by the start of class on date indicated in the schedule.

Three or four chapters from the course text *Teaching Science to Science: An Inquiry Approach*, will be designated for each class meeting (see class schedule for chapter assignment). 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 (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; Cmap Tools (free download available at [http://cmap.ihmc.us/download/dlp\\_CmapTools.php?myPlat=Win](http://cmap.ihmc.us/download/dlp_CmapTools.php?myPlat=Win)) or inspiration (free trial download available at [www.inspiration.com](http://www.inspiration.com)). 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 RAJE if you are unable to share the concepts with the class.

Each concept map has a possible total of 4 points.

- a) Map shows clear hierarchy or relationship.....worth 1 point
- b) 15-25 concepts included.....worth 1 point
- c) 1-2 words (nouns) for Concepts.....worth 1 point
- d) Verbs or prepositions for Linking Words between Concept...worth 1 point

### **3. Hands-on Science Lesson Plan and Presentation –20 Points - Due on the day of Presentation**

Spirit of the Assignment is to develop and teach a particular kind of a science inquiry lesson that teaches both science thought processes and science content using the learning cycle instructional model.

You will work in groups of two or three (Group sizes TBD based on class size) to lead a science lesson 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 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, and should emphasize specific science concepts. The Exploration and Application phases of the Learning Cycle require different hands-on science activities and manipulatives. **Begin Exploration with students making predictions/ answering essential questions or completing a challenge.** 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 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.

Your lesson plan should apply strategies for English Language Learners and adaptations for students with special needs and adaptations for GATE students.

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 or after the lesson.

**IMPORTANT NOTE:** After you have presented your lesson, you should post a copy of the lesson plan on WebCT for access by your classmates and bring one copy to class for the Instructor on the day of your presentation.

After your presentation (by the next class), turn in your **Reflection as described in assignment #4.**

#### **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?

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

**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):** 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):** 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?”

**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 2<sup>nd</sup> hands-on SCIENCE activity.)

**Web Sites:** 3 interactive relevant web sites with descriptions

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

## **4. Hands-on Learning Cycle Lesson Reflection – 10% points**

### **Due in the next class session after 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 developmental needs 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 students 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 if necessary.

### 5. Science Fair Exploratorium Lesson & Presentation: 20 Points

Develop an inquiry activity that uses a discrepant event appropriate for elementary students. You will work in groups as assigned in class.

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 an Elementary School Science Fair Exploratorium. The audience will be K-6 grade student at an elementary school to be identified later in the semester. 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 students.

Turn in your typed abbreviated 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. Learning Objectives
4. California Science Content Standards addressed
5. Exploration Activity
6. Concept Invention
7. Concept Application Activity

### 6. Web Resources for Science Teaching and Learning – 20 points

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 science lesson by providing **opportunities for your students to use technology**. The following questions should frame your planning:
  - i. How will you organize and manage the environment so that all students have access to the technology they will use in your lesson?
  - ii. How will you assess whether or not your students have reached the learning objectives of your lesson?
  - iii. How will you assess whether or not the technology your students used helped them reach the learning objectives?

In summary, in your lesson plan create a category called “Integration of Technology”:

1. Describe in full detail the technology you are 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? (State as student learning objectives. Should address the science content objectives)
- ii. What will the students do? Describe the task exactly as it will be given to students. This may be framed as a “challenge” task (Needs to use the language appropriate for the grade level students).
- iii. What forms of products (student work) will the students generate from the technology experience? (Indicate to the students what you want them to turn in. Should read something like... “At the end of this project you will be required to submit a.....”
- 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.

**NOTE\*\*\*** Please access the ISTE NETS for Teachers (NETS•T) for this assignment. Use Standards II and III as a checklist during your planning

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.

### **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 (a minimum of 3 hrs). This could be a field trip, museum, a nature center or some other equivalent experience that will assist you either directly or indirectly in becoming a science teacher. Your choice!! After the visit: 1) Prepare and present to class a 5 minute PowerPoint presentation to the class during class one of the classes. Your PowerPoint should address a description of the site, what you did for the 3 hrs at the site, resources available for science teaching, (bring samples to class if possible), a summary of what science you learned and implications for your own teaching. Discuss with the instructor about the class time in which you may do the presentation.

## **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

<b>Class #</b>	<b>Topic/Activity</b>	<b>Readings &amp; Work Due</b>
1 9/02	Course Overview <b>The Nature of Science</b> What makes a good science Teacher? How do we make decisions about what to teach and how we teach it? <i>-Introduction to Learning Cycle Inquiry approach to instruction</i>	Bring Syllabus to class -Read Learning Cycle Handout on WebCT
2 9/09	<b>CA Science Frameworks and Standards:</b> What are the overarching themes that we want students to learn in science? - Standards tasks What shall we use as indicators that students have learned and understand the intended outcomes? <i>-Assessment – Writing objectives to support Assessment</i> <i>-Hands-on science activity</i>	-Bring Science Education Standards to Class -Read First 3 Chapters of the California Science Frameworks. - RAJE on Ch. 4,5, 6 Due
3 9/16	<b>Science Kits &amp; Resources for Science Teaching:</b> What Activities of Teaching shall we use to make the content accessible to ALL students? - Assessments of Understanding - Focus on sequencing instruction -Understanding the Learning Cycle <b>Lesson Planning:</b> How shall we sequence the learning activities so that students can learn the intended themes? -Learning Cycle Activity on circuits	-RAJE on Ch. 7, 8, 9, Due  Draft Lesson Plan Due after class
4 9/23	<b>Learning Cycle Science Lesson Demonstrations:</b> What strategies can we use to ensure participation of ALL students in science learning? -Units Planning & Integrating Science with other subjects -Developing Unit Assessment plans	-Hands-on lesson presentations x4 -RAJE on ch. 11,12, 13 Due
5 9/30	<b>Learning Cycle Science Lesson Demonstrations</b> -Current Issues in Science Education/Using Current events for science teaching -Science Fairs and models of Inquiry	-Hands-on lesson presentations x4 -RAJE on ch. 14, 15, 16, 17 Due -Lesson Reflections Due from Previous Presenters
6 10/07	<b>Learning Cycle Science Lesson Demonstrations</b> -Safety in Elementary Science Classrooms -Technology for science Teaching - Developing Science WebQuests	-Science Fair Lesson Plan Due -Hands-on lesson presentations x4 -RAJE on Ch. 18, 19,20, 21 Due -Lesson Reflections Due from Previous Presenters
7 10/14	<b>Science Fair Exploratorium Presentations at a Local School</b>	-Science Fair Lessons Presentations at a Local School -Lesson Reflections Due from Previous Presenters
8 10/21	<b>Adapting Science curriculum for children with Special Needs</b> Course Evaluations	-Technology Resources Assignment Due

\* RAJE = Reading Accountability Journal Entry

### NOTE

*\*Due to the devastating effects of current budget crisis in California, I have been furloughed nine days each semester of this academic year, representing a 9.23% reduction in both workload and compensation. A furlough is an unpaid day off on a faculty member's regularly-scheduled workday. In order to satisfy legal and ethical requirements of the California Labor Code, I am required to submit formal certification that I will not work on my furlough days. I am prohibited from teaching, conducting scholarly research, consulting with students, responding to email or voicemail, providing assignment feedback, or participating in any CSU work-related activities on my furlough days. Furlough dates vary by professor; my Fall Semester furlough dates are: 9/03, 9/21, 10/08, and 10/09.*