

**CALIFORNIA STATE UNIVERSITY SAN MARCOS  
COLLEGE OF EDUCATION  
EDMI 545 – Middle Level Science Education  
Spring 2007 – Meeting Time Varies. See class Schedule  
Woodland Park Middle School**

General Information:

Instructor: Dr. Moses K. Ochanji  
Office: 313 University Hall  
Phone: 760 750 8546  
Fax: 760 750 3237  
E-mail: [mochanji@csusm.edu](mailto:mochanji@csusm.edu)

Office Hours: Before and After class

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:**

Abruscato, J. (2004). Teaching Children Science: A Discovery Approach, MyLabSchool Edition, SafariX eTextbook, 6/E (Text available via online subscription for half the price of the print copy at: <http://www.safarix.com/0205463649> )

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 Good 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 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 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 a middle school 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.

## **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 one letter grade. If you are absent for one class session your highest possible score will be A-. If you are absent twice your highest possible score will be B+ etc. Late arrivals and early departures will affect your final grade as well. 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.

## **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. Reading Accountability Journal Entries (RAJE) 5%
2. Science Teaching Artifacts and Resources (STARs) Collections – 10%
3. Leadership on Hand-on science lesson (Group sizes to be determined) 20%
4. Essential Questions Quiz 20%
5. Science Fair Project and Presentation – 20%
6. Science Teaching Unit and Presentation 20%
7. TPE reflection and response Via Task Stream 5%

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 and for your science notebook. You will not be assigned a course grade unless all the 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.

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. Reading Accountability Journal Entries for Ch. 2-18 (individual). 50 points**

**Due at the start of each class session**

The assigned readings provide an important foundation for your increasing understanding of how to effectively teach science. To aid you in remembering the readings, and assist you with meaningful class participation, you are asked to respond to each reading assignment by coming to class with a 1-2 page entry in your Reading Accountability Journal. (You will need to purchase 2 large Blue Books). Reading accountability journals will be collected at random dates in class. Be sure to always bring the notebooks to each class session. You will only receive full points if completed by the date indicated in the schedule.

For each of chapters 2 -18, complete one of the following in a large Blue Book (purchase 2 large books):

1. Prepare a concept map (10-15 concepts with linking words), using correct **concept mapping procedures taught in class** or
2. Prepare a Big Ideas “paper” explaining the key science concepts (**sentence form, not outlines**)

Put your name and date at the top of each page

Grading: Maximum of 5 pts for each chapter’s concepts.

### **2: Science Teaching Artifacts and Teaching Resources (STARs) Collections: 100 Points**

Spirit of the assignment is for the entire class to collectively establish a collection of resources and artifacts for teaching middle level science grades. Each class member will be assigned one standard for which they will collect and align resources and artifacts throughout the semester as they emerge through various course activities. Students will need to go beyond the class activities to add to the collections. A matrix of required artifacts will be developed in class. At the end of the semester, the entire class will put together one complete matrix for the entire set of middle level science standards.

### **3. Hands-On Science Lesson Presentation –200 Points - Due on assigned day for the lesson**

Spirit of the Assignment: to develop and teach a particular kind of a science inquiry lesson that teaches both science thought processes and science content.

You will work in groups of two or three 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 middle school students. However do not ask your colleagues to act as elementary kids.

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 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.

The lessons should include hands-on lessons, and should emphasize particular science concepts. The Exploration and Application phases of the Learning Cycle require different hands-on science activities using manipulatives. **ALWAYS begin Exploration with students making**

**PREDICTIONS.** 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. **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 6-8 grade students, and should follow the NSTA Safety Guidelines. **Begin the lesson by writing essential questions about the lesson on the board, for students to consider during the lesson.** These questions should be **higher level questions** (analysis, synthesis or evaluation level) according to Bloom’s Taxonomy. Make sure that you include the **3 stages of the Learning Cycle. Begin the lesson with students writing their predictions about the outcomes of the activity.** Make sure that science content background and applications to everyday life are addressed. You need to **EXPLAIN** Strategies for English language learners and adaptations for students with disabilities.

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. Additionally, include a list of at least 5 web sites (with short descriptions) that address the science topic and concepts through simulations, graphics and movies. You should have links to these web sites and show examples during the lesson.

### **Science Lesson Handout**

- Prepare a handout which includes the information under Lesson Plan Format, making sure you include:
  - team members’ names at the top
  - references at the bottom.

After teaching the lesson in class, you should each complete the peer evaluation and reflection form (*form provided separately*). The reflection should include strengths, weaknesses, and recommendations for improvement. Each person should turn in the reflection at the next class session, along with a copy of your Peer Evaluation form.

**IMPORTANT NOTE:** At least **three full days PRIOR to your team’s presentation**, email your complete lesson plan and your PowerPoint Presentation to the instructor for review. Include your cohort and the date you will present to the class. After I have approved these, you should post a copy of the lesson plan on WebCT for access by your classmates. After your presentation (by the next class), turn in your **Reflection and your Peer Evaluation Form.**

### **Lesson Plan Format**

**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 one science area (life science, physical science, or earth science) standard and one investigation standard.

**Lesson Objective(s):** What do you want students to be able to do?  
Write in complete sentences. Use an action verb and explain how students will demonstrate their new knowledge and understanding. “The students will \_\_\_\_\_.”

**Science Concept(s):** What are you trying to teach (one paragraph)? Do not say “The students will \_\_\_\_.” (That is an objective, not a concept.)

**Essential Questions** (higher level; see Bloom’s taxonomy): What are your essential question(s) for this concept? What leads to the big idea?

**Assessment:** How will your students demonstrate that they have met the objective? 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?

#### **The Learning Cycle**

- a. Exploration (Begin with students making predictions.)
- b. Concept Invention
- c. Concept Application

**Be sure to** explain the procedures for each of the three phases. Include what the teacher will do and what the students will do.

#### **Accommodations/Adaptations/Applications:**

- Strategies for English language learners and explanations (5)
- Adaptations for students with disabilities and explanations (5)
- Applications to everyday life and explanations (5)

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

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

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

### **4. Essential Questions Quiz – 200 Points**

The goal of this assignment is to ensure that students pay attention to the relevant grade level content of the lessons developed in class. The quiz will be based on the essential questions stated in your hands-on lesson assignments. This quiz will be open notebook, but not open handout. That means you should take careful notes during each lesson presentation. If you take your notes on the computer, be sure to print them prior to coming to class on the day of the quiz.

### **5. Science Exploratorium/ Science Fair Presentation – 200 Points**

Develop an inquiry activity that uses a discrepant event appropriate for 6<sup>th</sup> grade 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 6<sup>th</sup> grade students during a School Science Fair Exposition. The audience will be 6<sup>th</sup> grade student at a local 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 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?)
  - a. How do the children’s actions and responses demonstrate their level of understanding?
  - b. How did you (or can you) improve upon your lesson to facilitate understanding?

After the Exploratorium, you will do a self-assessment by completing the rubric on available on WebCT.

**Turn in your self-assessment rubric and your reflection at the next class session.**

## **6. Science Teaching Unit and Presentation—200 Points**

The goal of this assignment is for the student to develop long term planning for instruction as well as developing skill for integrated teaching in middle school grades. For this assignment, you will plan a unit of instruction for an appropriate grade for an interdisciplinary team that includes science and other subject areas as desired. This unit will be appropriate for approximately two – three weeks of instruction for a heterogeneous elementary classroom. You will work with one or two partners of your choosing.

Details of this assignment will be shared in class. Pay attention to the description when completing this assignment.

## **7. Teaching Performance Expectations (TPEs) Competencies Via Taskstream – 50 Points**

### **Standards of Quality and Effectiveness for Professional Teacher Preparation Programs California Commission on Teacher Credentialing**

This course is designed to help those seeking a Multiple Subjects Credential develop the skills, knowledge and attitudes necessary to assist schools and districts in implementing effective



programs for all students. The successful candidate will be able to merge theory and practice in order to realize a comprehensive and extensive educational program for all students. Students will document their knowledge and understanding of TPE 1A and TPE5 through assignments completed in EDM 545

For each of the TPEs write a one page maximum reflection on how the course activities enable you to meet these two TPEs. You will be required to attach artifacts from the course that demonstrate your abilities as explained in your reflections.

## A. MAKING SUBJECT MATTER COMPREHENSIBLE TO STUDENTS

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

Candidates for a Multiple Subject Teaching Credential demonstrate the ability to teach the state-adopted academic content standards for students in science (K-8). They balance the focus of instruction between science information, concepts, and investigations. Their explanations, demonstrations, and class activities serve to illustrate science concepts and principles, scientific investigation, and experimentation. Candidates emphasize the importance of accuracy, precision,

## C. ENGAGING AND SUPPORTING STUDENTS IN LEARNING

TPE 5: Student Engagement

Candidates for Teaching Credentials clearly communicate instructional objectives to students. They ensure the active and equitable participation of all students. They ensure that students understand what they are to do during instruction and monitor student progress toward academic goals. If students are struggling and off-task, candidates examine why and use strategies to re-engage them. Candidates encourage students to share and examine points of view during lessons. They use community resources, student experiences, and applied learning activities to make instruction relevant. They extend the intellectual quality of student thinking by asking stimulating questions and challenging student ideas. Candidates teach students to respond to and frame meaningful questions.

**You will be using assignments and tasks from this course to meet these TPEs in the electronic portfolio.**

**\*\*NOTE: If you do not post the entries as directed, (1) you will not receive credit for the TPE entries and (2) you will not pass the 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

## APENDIX A: Tentative Class Schedule

Class	Date	Topic	Readings & Work Due
1	1/22 AM	Course Overview The Nature of Science and Inquiry Process in Science	<b>Bring Syllabus to class</b>
2	1/29 PM	How do we make decisions about what to teach and how we teach it? -The Learning Cycle inquiry approach to instruction	-Read Learning Cycle Handout on WebCT -RAJE* on LC and ch. 3
3	1/31 AM	What are the overarching themes that we want our students to learn in science? -Focus on standards and Frameworks	<b>-Bring Science Education Standards to Class</b> -RAJE on CA Science Framework pgs 1-32
4	2/02 AM	What shall use as the best indicators that students have learned and understand the intended outcomes? -Focus on Assessment	- RAJE on Ch. 6
5	2/09 AM	How shall we sequence the learning activities so that students can learn the intended themes? -Focus on sequencing instruction	<b>-Bring a Science textbook to class</b> -RAJE on Ch. 4
6	2/09 PM	What Activities of Teaching shall we use to make the content accessible to ALL students? -Hands-on Lessons – Focus on 6 <sup>th</sup> grade	-Hands-on lessons x2 -RAJE on ch. 11A & B
7	2/12 PM	What strategies can use to ensure participations of ALL students in science learning?	-Hands-on lessons x2 -RAJE on ch. 12A & B
8	2/19 AM	Developing Science WebQuests & Technology for science Teaching	-Hands-on lessons x3 -RAJE on ch. 14A & B
9	2/19 PM	STARs Collections	-Hands-on lessons x3 -RAJE on ch. 15A & B
10	2/22 AM	Adapting Science curriculum for children with Special Needs	-Hands-on lessons x2 -RAJE on ch. 17A & B <b>- Essential Questions Quiz</b>
11	2/27 AM	Units Planning & Integrating Science with other subjects Developing Unit Assessment plans	-RAJE on ch. 18 A & B <b>-Sc. Fair Lesson Plan Due</b>
12	3/02 AM	Science Projects, Student Research, Science Fairs and Science Safety -Writing TPEs	-RAJE on ch. 2 (make up entry)
13	3/05 AM	Science Fair with kids	
14	3/05 P.M.	<u>Science Fair with Kids</u>	<b>-Science Fair Reflection and -Rubric Due via WebCT</b>
15	3/12 P.M.	<u>STARs Matrix Presentations</u>	<b>-STARs Collections Due TPES Due via taskstream</b>

\* RAJE = Reading Accountability Journal Entry