CALIFORNIA STATE UNIVERSITY SAN MARCOS COLLEGE OF EDUCATION EDMS 545B – Science Education in Elementary Schools Fall 2010 – Meeting Time: Mondays 1.00 – 3.45 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. <u>Also available online</u>.

Other handouts will be distributed in class or through Cougar Courses.

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://wwws.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. <u>A make-up assignment will be available for up to two classes (10% points)</u>. 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 <u>ALL</u> 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) 5%
- 2. Reading Accountability Journal Entries (CONCEPT MAPS) (Individually Assigned) 20%
- 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)– 5%
- 6. Science Fair Exploratorium Lesson & Presentation (Groups sizes TBD) 20%
- 7. Technology & Web Resources for Science Teaching and Learning (Individually Assigned) 20%
- 8. 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: 5%

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 loose 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 - 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. 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 <u>Concept Map</u>. 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 <u>choose one of</u> 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 <u>www.inspiration.com</u>) or Cmap Tools (free download available at <u>http://cmap.ihmc.us/download/dlp_CmapTools.php?myPlat=Win</u>). 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 4 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.

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 <u>demonstrate understanding</u> 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 <u>Bloom's Taxonomy</u>). 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 <u>students share and discuss data and ideas in the first part of this stage;</u> 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 – 5% 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. 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 4/5 grade students 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. 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. Lesson Objectives
- 3. California Science Content Standards addressed
- 4. Exploration Activity
- 5. Concept Invention
- 6. Concept Application Activity

7. 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. This assignment is tied to your Capstone research project in ID 381. In the capstone research project, you will be conducting a scientific research on a given science topic. In this assignment, your task is to think about how you can invite K-8 students to participate in some aspects of your resource project through the use of a webquest.

Procedures to follow:

a. Read Chapter 3 in the Friedl Text.

b. You will integrate technology in your capstone research project by providing opportunities for K-8 students to use technology to explore or access the content and/or skills associated with your capstone project by creating a webquest tied to your project research. <u>Use filamentality or a similar webquest creation template</u>. Your webquest must include but not limited to the following:

Introduction – What is the task about and what learning objectives will it achieve

Task - What will the students do? Describe the task that you will assign to students. This may be framed as a "challenge" task.

Process: How will the students go about doing the task?

Resources: What resources are available for students to complete the task (should include web resources)

Product: What products (student work) will the students generate from the webquest?

Evaluation: How will the products be assessed and evaluated? Include the rubric that will be used.

Your final webquest will be submitted as a link through the Cougar Course site and you will share your webquest as part of your capstone project presentation. Credit for this assignment includes the webquest itself and the presentation.

8. 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 up to two entire classes or a combination of up to three late arrivals and/or early departures or points missed on other assignments. 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 but you may not use an activity attended prior to the first day of this class!! However, you may revisit a site you have previously visited.

To complete this requirement: 1) Visit a science related informal site or formal event or presentation; 2. Prepare a written summary of your visit documenting what you did for the 3 hours you were at the site, what science ideas and concepts you learned from the visit or presentation and how the visit or presentation can be applied to teaching in K-12 environments; 3) Post your write up to the Cougar Course site related forum; 4) do a 5 minute PowerPoint presentation to the class during class one of the classes addressing the what you did, what you learned, how it can be applied, highlighting resources from the site . Discuss with the instructor about the class time in which you may do the presentation.

Class	Date	Торіс	Readings & Work Due
1	8/30	Course Overview	Bring Syllabus to class
		The Nature of Science and Inquiry Process	
		in Science	
		How do we make decisions about what to	
		teach and how we teach it?	
2	9/13	What are the overarching themes that we	- Read Chapter 1 & 2 of Teaching Science to Children
		want our students to learn in science?	- Read the CA Science Framework pgs 1-32
		-Focus on standards and Frameworks	-Bring Science Education Standards to Class
		-Focus on sequencing instruction	
3	9/20	How shall we sequence the learning	- Read Learning Cycle Handout and bring a copy to
		activities so that students can learn the	class
		intended themes?	- Read Chapter 4 or 5 or 6 of Teaching Science to
		-Focus on using the Learning Cycle to	Children
		teach science as inquiry	- CONCEPT MAP #1 on one of Ch. 4, 5, 6 due
		- Instructor-Lead Hands-on Activity	
4	9/27	What shall we use as the best indicators	- Read Chapter 7 or 8 or 9 of Teaching Science to
		that students have learned and understand	Children
		the intended outcomes?	- CONCEPT MAP #2 on one of Ch. 7, 8, 9 due
		- Focus on Assessment	
		- Focus on Lesson Planning	
		- Instructor-lead Hands-on Activity	
5	10/04	Writing Lesson Plans	No Formal Class meeting.
6	10/11	What Activities of Teaching shall we use to	- Read Chapter 10 or 11 or 12 - CONCEPT MAP #3
		make the content accessible to ALL	on one of Ch. 10, 11, 12 due
		students?	-hands-on Lesson Plans Due
		-Hands-on Lessons Presentations	-Hands-on lesson Presentations x 2
7	10/18	What Activities of Teaching shall we use to	Read Chapter 13 or 14 or 15 - CONCEPT MAP #4 on
		make the content accessible to ALL	one of Ch. 13, 14, 15 due
		students?	- Hands-on lesson Presentations x3
		-Hands-on Lessons Presentations	-hands-on Lesson Reflection Due from 1 st presenters
8	10/25	What strategies can use to ensure	- Read Chapter 16 or 17 or 18 - CONCEPT MAP #5
		participations of ALL students in science	on one of Ch. 16, 17, 18 due
		learning?	-Hands-on lesson Presentations x 3
		-Hands-on Lessons Presentations	-hands-on Lesson Reflection Due from 2 nd presenters
9	11/01	-Science Fair Exploratorium Preview	- Read Chapter 19 or 20 or 21
		- Safety Guidelines for Science Classrooms	- CONCEPT MAP #6 on one of Ch. 19, 20, 21 due
		Units Planning	-hands-on Lesson Reflection Due from 3 rd presenters
			- Science Fair Exploratorium Lesson Due
10	11/08	Science Fair Exploratorium	Class meets at Twin Oaks Elementary School
11	11/15	-Science Fair Exploratorium Reflection	Read Chapter 3 of Teaching Science to Children
		- Developing Science Web Quests &	
		Technology for science Teaching (meets in	
		a computer lab)	
12	11/22	Capstone Project Integration- Open Class	
13	11/29	Adapting Science curriculum for children	-Web Resources Assignment Due
		with Special Needs. Course Review	
14	12/10	Class combined with ID 381	Capstone Presentations

APENDIX A: Tentative Class Schedule

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