

California State University San Marcos
College of Education
EDMI 545 – Middle School Science Education

General Information:

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Office Hours: 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.

Required Textbooks:

Abruscato, J. (2000) Teaching Children Science: A discovery approach. New York, Pearson Allyn & Bacon.

Koballa, R. T., & Tippins, J. D. (2000). Cases in middle and secondary science education: The promise and dilemmas, (2nd Ed.) Upper Saddle River, NJ: Pearson Merrill Prentice Hall.

Other handouts will be given in class or through WebCT (WebCT: <http://courses.csusm.edu/>)

Other Good Books:

Successful Inclusive Teaching. By Joyce S. Choate

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

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

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

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

These are in the bookstore, but there are many excellent hands-on science books. Look in bookstores, museums, teacher stores, even grocery stores!

COE MISSION STATEMENT

The mission of the College of Education Community is to collaboratively transform public education by preparing thoughtful educators and advancing professional practices. We are committed to diversity, educational equity, and social justice, exemplified through reflective teaching, life-long learning, innovative research, and on-going service. Our practices demonstrate a commitment to student-centered education, diversity, collaboration, and professionalism and shared governance.

COURSE DESCRIPTION

This course is designed to provide a comprehensive overview of the objectives, skills, concepts, experiments, materials, and methods necessary to teach science to middle school children. A series of group activities will provide you with first-hand experiences in these areas. This course focuses on instructional methods, techniques, materials, lesson planning, curriculum development, organization and assessment in science content areas. The integration of curricular areas is addressed. Methods of cross-cultural language and academic development will be integrated in to the course.

COURSE OBJECTIVES

By the end of this course, students should be able to

1. Demonstrate proficiency with inquiry skills of observing, measuring, inferring, classifying, predicting, verifying predictions, hypothesizing, isolating variables, interpreting data, and experimenting.
2. Identify exemplary materials (curriculum kits, science programs, textbooks, equipment, technology, ancillary materials) appropriate for elementary 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 alternative methods of assessment to evaluate student learning of science concepts and processes.
9. Practice strategies to include all students in science (linguistically and culturally diverse, students with disabilities and other students with special needs).

INFUSED COMPETENCIES

Special Education

Consistent with the intent to offer a seamless teaching credential in the College of Education, this course will demonstrate the collaborative infusion of special education competencies that reflect inclusive educational practices.

Technology

This course infuses technology competencies to prepare our candidates to use technologies, emphasizing their use in both teaching practice and student learning.

Authorization to Teach English Learners

This credential program has been specifically designed to prepare teachers for the diversity of languages often encountered in California public school classrooms. The authorization to teach English learners is met through the infusion of content and experiences within the credential program, as well as additional coursework. Students successfully completing this program receive a credential with authorization to teach English learners.

Teacher Performance Expectation (TPE) Competencies

The course objectives, assignments, and assessments have been aligned with the CTC standards for Multiple Subject Credential. This course is designed to help teachers seeking a California teaching credential to develop the skills, knowledge, and attitudes necessary to assist schools and district 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. You will be required to formally address the following TPEs in this course:

- TPE 1A: Teaching Science in a Multiple Subject Assignment
- TPE 5: Student Engagement
- TPE 6B: Developmentally Appropriate Practices in Grades 4-8

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

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.

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

EISENHOWER NATIONAL CLEARINGHOUSE

<http://enc.org>

The Eisenhower National Clearinghouse (ENC) has recently launched an all-new web site, ENC Online, at <http://enc.org>. ENC, which was established by the U.S. Department of Education, provides K-12 math and science educators with information about teaching materials, innovative ideas, and professional development.

The content on ENC Online has been organized into four major categories. They are Curriculum Resources, Web Links, Professional Resources, and Topics. Through Curriculum Resources, teachers can locate teaching or professional development materials using subject words, grade level, cost, and type of material to meet their specific needs.

Teachers have said that the Digital Dozen, a monthly selection of exemplary math and science web sites, is one of their favorite features on the site. It is now found in the Web Links area. (Teacher can now also choose to have Digital Dozen delivered to their email boxes when registering with ENC.) Web Links also includes links to sites offering lesson plans, arranged by math or science topics.

The Professional Resources area is intended to become a part of a teacher's professional support system. A Timesavers section found within the Professional Resources area offers a collection of the most popular professional resources in one place for quick linking and use. Standards and state frameworks are also found under Professional Resources, as are federally funded resources, professional development strategies, and research articles.

ENC has always created projects and publications on relevant topics for teachers. The Topics area arranges hundreds of articles, teacher interviews, and selected curriculum resources and web sites thematically. Key education issues addressed in the Topics area include inquiry and problem solving, integrating educational technology, equity, and assessment. These areas include the materials developed for ENC Focus, our quarterly magazine for math and science educators.

COURSE REQUIREMENTS

COE Attendance Policy

Due to the dynamic and interactive nature of courses in the COE, all students are expected to attend all classes and participate actively. At a minimum, students must attend more than 80% of class time, or s/he may not receive a passing grade for the course at the discretion of the instructor.

My Attendance Policy

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

Absences do not change assignment due dates. Late assignments will receive a 10% reduction in points for each day late. After one week, late assignments will receive no credit. If your printer breaks, use a CSUSM computer lab to print out your work.

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.

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****You must go to ACD 202 to activate your CSUSM e-mail account, or provide another email address.**

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."

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

1. Participation, Collaboration, Professionalism & Discussion Questions (Individual) 10%
2. Leadership on Hand-on science lesson (Group sizes to be determined) 20%
3. Science Fair Exposition (may work in pairs) 25%
4. Science Teaching Unit and Presentation 15%
5. Incidental Assignments and Quizzes 25%
6. Science Teaching Notebook (Individual) 5%

Late assignments will be penalized by a 10%-point reduction each day they are late.
Keep digital copies of all assignments for your Credential Program Electronic Portfolio.

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. PARTICIPATION, COLLABORATION AND PROFESSIONALISM (PCP) (individual) *(60 points) Due on 3/11/05*

You will do a self-assessment using the teacher dispositions using the rubric provided on WebCT and write a one-two page rationale. You should give a rationale for the points you gave yourself in each area of the rubric and provide examples for each area. Your professors will also do an assessment using this rubric based on the following dispositions:

- General classroom attendance, promptness, and participation: is on time, respects time boundaries (breaks, etc.), regularly attends class, and actively participates.
- Attention to classroom discussion protocols (per Epstein's Five Stage Rocket): respects time limitations, recognizes and respects the perspectives of fellow classmates, gives wait time, listens actively, uses non-interruptive skills, mediates disagreements by working to understand others' perspectives and finding common ground, genuinely encourages all to participate.
- Social and cooperative skills (as illustrated in cooperative projects): assumes responsibility of one's roles, is open to consensus and mediation, effectively communicates ideas, attends group meetings, is dependable, respects others' ideas, expects quality work from self and colleagues, manages time effectively, uses organizational skills and leadership skills, is assertive but not aggressive, uses reflection as a means of evaluation, motivates and offers positive reinforcement to others.
- Attention to assignments: meets time deadlines, produces quality products, responds cooperatively to constructive criticism, uses rubrics or other stipulated criteria to shape an assignment, prioritizes tasks and performs/supervises several tasks at once.
- General classroom demeanor: is professional, creative, kind, sensitive, respectful, has a sense of humor, is supportive of fellow classmates and instructors; recognizes others' perspectives as valid and works to include all "voices" in the classroom; is aware of and responsive to issues and behaviors that might marginalize colleagues in the classroom.
- Flexibility: is responsive when reasonable adjustments to the syllabus, curriculum, schedule, and school site assignments become necessary (common to the educational arena); can work through frustrations by problem-solving with others and not letting emotional responses dominate or impair thinking; "bounces" back easily; can work calmly under stress.
- Openness to, and enthusiasm for learning: can engage with a variety of educational ideas with an open mind and a sense of exploration; demonstrates passion for and metacognition of learning across the curriculum and within discipline areas; takes advantage of learning opportunities and seeks out additional opportunities for learning.

2. DISCUSSION QUESTIONS: *(Based on Readings from Learning from Cases Textbook) part of the PCP assignment above Due on the day of class – 40 points*

Each student will be required to submit a discussion question for the class based on the readings of the assigned chapters from the book - *Cases in Middle and Secondary Science Education*. Half the class will submit questions for AM readings and the second half will submit questions for PM readings for a given day. As a result each student will submit one question every week.

At the end of the 8 weeks copy and paste your individual questions as posted on WebCT with date and time submitted and turn in to the instructor for a grade. Late submissions will not be accepted. Since the questions will be used to direct the class discussions and activities, if you submit a question beyond the expected time, it will not count towards your grade for this assignment.

The question should be submitted to the WebCT class postings under the heading identified for discussion questions by 8.30 a.m. on the day of the class when such readings are assigned. The specific chapters assigned for each day are shown in the class schedule in the appendices to this syllabus. The discussion question should be an open-ended question that provides opportunity for discussion and calls for diverse responses. In addition it should reflect that you read the assigned readings. The dates when the questions are due are reflected in the course schedule. Examples of such questions will be available on WebCT.

3. LEADERSHIP OF HANDS-ON SCIENCE LESSONS – *Critical Assessment Task (CATs)* *200 points - Due on assigned day for the lesson*

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 grade school 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.

Your Hands-On Learning Cycle Science Lesson will have two parts:

Part I. Each team will present one lesson that follows the Learning Cycle lesson format and will emphasize a science concept related to the California Science Standards. The lesson will have at least one hands-on activity, it is 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 science process skills with science manipulatives. Each hands-on activity is required to have predictions made and recorded before beginning the activity. And a data sheet where students can record observations or data collected from the activity. Try to have students make quantitative measurements (length-meters, weight-grams, time), remember to use metric units of measurement.

The Learning Cycle lesson format

- I. Grade Level and California Science Standard the lesson is addressing
- II. Objectives (3-4) (use behavioral objectives with action verbs—i.e., The students will ____)
- III. Two essential questions that the learner should be able to answer after the lesson and background information, what information would a teacher need to teach the lesson, if they didn't have any science background on the particular concept.
- IV. Materials needed for the lesson

- V. Exploration Phase, describe the procedure in detail for conducting the exploration phase of the lesson. What will the teacher and students do, what are possible questions the students will have? (see rubric for details)
- VI. Concept Invention Phase Describe in detail how to teach the concept. (see rubric for details) Include the use of your PowerPoint here.
- VII. Concept Application Phase how will you specifically address this section. If at all possible include other hands on activity. (see rubric for details)
- VIII. SDAIE strategies
- IX. Adaptations for students with disabilities
- X. A 1-2 page summary of the science content background
- XI. A list of 5 relevant web sites (with descriptions)
- XII. Applications to everyday life.

- Resources from the Internet may be used as part of Concept Invention Phase. Images, movies, simulations, sounds, and other exciting resource are available free over the Internet.
- Be sure you understand the concepts you are teaching, and that you can explain them.
- The lesson should be developmentally appropriate for the appropriate grade level and should follow the NSTA Safety Guidelines.
- Make sure that you include the three stages of the Learning Cycle and that the science content background is addressed.

Part II. Share a description of websites (at least five) used in developing the lessons in your handout to the class. Share any other pertinent information a teacher would need to present the lessons. Also take time to present the detailed textbook content related to the topic beyond what the lesson covers that is relevant for the unit in that topic. You should use PowerPoint for this part.

Each group will prepare a handout that includes the lesson that the team presented, a description of websites used. Bring copies of the activity (for everyone in class) with group members' names at the top.

4. INCIDENTAL ASSIGNMENTS AND QUIZZES – 250 points

The quizzes will be given twice. They will be based on the essential questions stated in your hands-on lesson assignments. After about half the lessons have been presented and after the last hands on lesson has been presented, a quiz will be given on the content of the events. The course instructor will design the quiz based on the questions submitted by each partner pair on their hands-on lesson. These quizzes will be open notebook, but not open handout. That means you should take careful notes during each lesson presentation.

5. SCIENCE FAIR EXPOSITION – Critical Assessment Task (CATs) 250 points Due TBA

Develop an inquiry activity that uses a discrepant event appropriate for middle level students. You may work in teams of 2 on this assignment.

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 a Science Fair Exposition at a local school. The audience will be 6th grade student at a 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 student.

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?

6. SCIENCE TEACHING UNIT AND PRESENTATION– *Critical Assessment Task (CATs)* *150 points Due 3/8*

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 middle level classroom. You will work with one or two partners of your choosing. Details of this assignment will be shared in class.

7. SCIENCE TEACHING NOTEBOOK (*individual*) *50 points Due 3/8*

You will keep a class notebook, and will meet with the instructor during the last class period to review contents. Please use section dividers and labels for sections. For some assignments, you may need to make copies in order to include everything in your notebook.

Alternative to the hard copy notebook, you may organize your notebook electronically and submit a CD copy to the instructor on the last day of class. This alternative is not required but highly recommended.

- I. California Science Content Standards for grades K-6 (download from <http://www.cde.ca.gov/board/pdf/science.pdf> and print)
- II. Discussion questions (those submitted by you)
- III. Learning Cycle Lessons presented in class
- V. Science Fair exposition lesson and reflection
- VI. Science Unit Plan
- VII. Other Class Handouts and incidental assignments.

VIII. Grade Sheet

Extra Credit (Directors Role):

Be a director, according to the list below. 20 points

- Director of Directors – Assigns Directorships – keeps list
- Syllabus director – holds a hard copy of the Syllabus so other students can make copies
- Ensures students get updated versions of syllabus –email or WebCT
- Name Tag Director – Make sure everybody has a name tag each class
- Contact Information/Community affairs Director—Make class list with current contact info & Keep records of class events such birthdays etc
- Attendance Director: Maintains attendance sheet and ensures that everybody present in class signs for attendance.
- Photographer – takes photos of various class activities. Shows them to class.
- Webmaster – Find science/science ed websites coordinate, WebCT tasks – present to class
- Time Keeper – Keep time for allocated tasks and presentations and breaks
- Environmental Directors – Ensures tightness of the room after class as well as environmental related issues
- Science & Education News – Collects and shares science news from various resources with class –videos, newsclips etc
- Note Taker – Takes notes of important communiqué can shares with class
- Science Fair coordinator – Coordinates Science Fair event
- Noise Control

Tentative Class Schedule

<u>Class #</u>	<u>Date/Time</u>	<u>Topic</u>
1	1/19AM	Course Overview: What is Science? The Nature of Science and Inquiry Process in Science Review Syllabus Sign up for Leadership of Science Activities Bring Syllabus to class
2	1/19PM	Teaching Tips: Constructing Knowledge and Discovering Meaning via the Learning cycle Hands-on activities
3	1/28AM	Teaching Tips: Inquiry Processes in Science Read Cases 2.1 through 2.4 from Koballa & Tippins. Question Due by Group A <i>Read Learning Cycle Handout on WebCT – by ALL</i>
4	1/28PM	Teaching Tips: Planning and Managing Inquiry based Lessons Read Cases 4.1 through 4.4 from Koballa & Tippins. Question Due by Group B Bring Science Education Standards to Class
5.	2/02PM	Problem-based learning & Activities Read Cases 6.1 through 6.3 from Koballa & Tippins. Questions Due by Group A
6	2/04AM	Teaching Tips: Using Cooperative strategies & questioning and Wait time as a Learning tools Read Cases 5.1 through 5.4 from Koballa & Tippins. Questions Due by A <i>Learning Cycle Lesson Presentations x2</i>
7	2/04PM	Teaching Tips: Assessment of Understanding and Inquiry Read Cases 10.1 through 10.4 from Koballa & Tippins. Question Due by B <i>Learning Cycle Lesson Presentations x2</i>
8	2/25AM	Teaching Tip: Unit Planning & Integrating Science with other subjects Read Cases 3.1 through 3.2 from Koballa & Tippins. Question Due by A <i>Learning Cycle Lesson Presentations x2</i>
9	2/25PM	Teaching Tips: Adapting Science curriculum for children with Special Needs Read Cases 3.3 through 3.4 from Koballa & Tippins. Question Due by B <i>Learning Cycle Lesson Presentationsx2</i>
10	3/02AM	Teaching Tips: Science WebQuests

Read Cases 9.1 through 9.3 from Koballa & Tippins.

Question Due by A

Learning Cycle Lesson Presentation x1

Science Exploratorium Lesson Due

11 3/02PM Teaching Tips: Science Projects, Student Research, Science Fairs and Science Safety

Read Cases 7.1 through 7.3 from Koballa & Tippins.

Question Due by B

Learning Cycle Lesson Presentations x2

12&13 **3/04 or TBA** Science Fair Exposition Day (Tentative date)

14 3/11AM Teaching Tips: State Approved Textbooks

Contemporary Issues in Science Education

Read Cases 8.1 through 8.4 from Koballa & Tippins.

Discussion Question Due by B

Unit Plans Due

Notebook Due

15 3/12PM Unit Plan Presentations

Teaching Tips: Teaching for Understanding & Professional Development for Middle level Science Teachers

Read Cases 11.1 through 11.3 from Koballa & Tippins.

NAME: _____

Grade Sheet

	Assignment Description	Max Score	Your Score	Letter grade
1	Hands-on Lesson Presentation	200		
2.	Science Fair Exposition	250		
3	Quizzes	250		
4	Unit Plan	150		
5	Discussion Questions	40		
6	PCP	60		
7	Notebook	50		
8	Directorship (Extra Credit Pts)	20		
	TOTAL	1000		

Comments: