

CSUSM MULTISUBJECT CREDENTIAL PROGRAM

Science Education in the Elementary School – EDMS 545

6-8:45 PM R UH 460

California State University San Marcos

Fall 2001

Dave Reynolds
Office Hours: Thursday 5:00-6:00 PM
or by appointment

Office: 423 University Hall
Phone: (760) 750-8516
Email: dreynold@csusm.edu

Required Teaching Children Science. An Inquiry Approach.

Textbooks: By Alfred E. Friedl. NY: McGraw-Hill.

EDMS 545 Science Education Course Handouts. Kathy Norman.

Other Good Books:

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

Great Explorations in Math & Science (G.E.M.S.) Booklets

Any Selection that matches a CA Sci 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: JohnWiley

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

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 elementary 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. The integration of curricular areas is addressed. Methods of cross-cultural language and academic development will be integrated in to the course. It is my sincere wish that the activities presented will motivate you to teach science to children in a confident, competent manner.

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 an understanding of basic science themes (energy, evolution, patterns of change, scale and structure, stability, and systems and interactions) and basic science concepts in the fields of physical science, earth science and life science.
4. Use the Learning Cycle model of instruction to teach science in a contemporary manner.
5. Use technology in elementary science teaching.
6. Demonstrate confidence in leading and performing investigations designed to teach science concepts, science process skills, and scientific attitudes. .

7. Use alternative methods of assessment to evaluate student learning of science concepts and processes.
8. Design a 3-lesson elementary science teaching unit.
9. Practice strategies to include all students in science (linguistically and culturally diverse, students with disabilities and other students with special needs).
10. Demonstrate knowledge and understanding of the National Science Education Standards and California Science Content Standards.

College of Education 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.

Statement of CLAD Infusion

In 1992, the College of Education voted to infuse Cross-cultural, Language and Academic Development (CLAD) competencies across the curriculum. The CLAD competencies are attached to the syllabus and the competencies covered in this course are highlighted.

Course Requirements

COE Attendance Policy: “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.”

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. Absences and late arrivals/early departures will affect the final grade. If you miss 3 class sessions or are late (or leave early) for more than four sessions, your highest possible grade is a B. If you miss 5 class sessions, your highest possible grade is a C. If you miss more than 20% of the class (6 class sessions), you may not receive a passing grade for the course. 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.

Professionalism: It is expected that students will come to class prepared to discuss the required readings, submit required assignments, and to participate in class activities. Teacher education is a professional preparation program. Students will be expected to adhere to standards of dependability, academic honesty and integrity, confidentiality, and writing achievement. Because it is important for teachers to be able to effectively communicate their ideas to students, colleagues, parents and administrators, writing that is original, clear and error-free is a priority in the College of Education. It is expected that work will be turned in on time. Absences do not change due dates. Late assignments will receive a 10% reduction in points for each day late. After one week, late assignments will receive no credit.

Literature Books and Science Activity Books: I will be bringing in literature books and science activity books to show you. You are encouraged to bring in similar books to share with the class. There are wonderful books at bookstores, museums, education conferences, book fairs, and stores such as The Nature Company and The Museum Store.

Professional Organizations and Professional Journals: You should join at least one professional organization and should receive at least one professional journal. There are many organizations in all areas and levels of teaching. Almost all have an educational journal, which will provide you with a continuous source of ideas and class activities. Even local organizations, such as the San Diego Science Educators Association, have newsletters. Student memberships are less expensive than regular memberships, so now is the time to join.

Course Outline

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

Class #	Date	Topic	Assignment Due
1	Aug. 23	Course Overview: Why Science? The Learning Cycle Model of Teaching Teaching Science in Inclusive Classrooms Classroom Questionnaire Review Reading Responses, Elementary School Science Exposition CA Science Standards Assignment, Science Teaching Unit Sign up for Directorships, Groups-Leadership of Science Activities <u>Learning Cycle Science Lesson</u> Activity Foss Motion Grade 2	
2	Aug. 30	Science News, Science Tips, Teaching Tips Ch. 1 Writing Objectives and Explanations of Science Concepts CA Science Content Standards Grades K-8 <u>Learning Cycle Science Lesson</u> : Foss Sound Grade 2	Reading Response
3	Sept. 6	Science News, Science Tips, Teaching Tips Ch. 2 <u>Learning Cycle Science Lesson</u> : Heat Energy Writing Objectives and Explanations of Science Concepts	Reading Response Turn in Classroom Questionnaire
4	Sept. 13	Science News, Science Tips, Teaching Tips Ch. 3 Beginning to Teach Science/SDAIE Strategies in Science <u>Learning Cycle Science Lesson</u> : Electricity	Reading Response
5	Sept. 20	Science News, Science Tips, Teaching Tips Ch. 7 Infusing Writing Activities in Science Lessons Ch. 6 <u>Learning Cycle Science Lesson</u> : Group 1-Magnetism	Reading Response Reading Response
6	Sept. 27	Meet in Computer Lab—Science Teaching Websites Science News, Science Tips, Teaching Tips Ch. 8 <u>Learning Cycle Science Lesson</u> : Group 2-Sound	Web Sites/Lessons Reading Response
7	Oct. 4	Science News, Science Tips, Teaching Tips CA Science Themes <u>Learning Cycle Science Lesson</u> : Group 3-Light, Color, Lenses	Standards Assignment Ch. 9 Reading Response

8	Oct. 11	Science News, Science Tips, Teaching Tips Science Curriculum Kits and State Approved Texts <u>Learning Cycle Science Lesson: Group 4-Air and Air Pressure</u>	Ch. 10	Reading Response
9	Oct. 18	Science News, Science Tips, Teaching Tips Science Process Skills and Scientific Attitudes <u>Learning Cycle Science Lesson: Group 5-Weather/Climate</u>	Ch. 11	Reading Response
10	Oct. 25	Science News, Science Tips, Teaching Tips Bring Science Activity and Poster for Science Exposition	Ch. 12,	Reading Response Exposition activity
11	Nov. 1	Science News, Science Tips, Teaching Tips John Glenn Commission Report on Science and Math Teaching <u>Learning Cycle Science Lesson: Group 1-Space Science/Sun, Moon, Stars</u>	Ch. 13,14	Reading Response
12	Nov. 8	Science News, Science Tips, Teaching Tips Authentic Assessments in Science <u>Learning Cycle Science Lesson: Group 2-Geology</u>	Ch. 15	Reading Response
13	Nov. 15	Science News, Science Tips, Teaching Tips Science Projects, Student Research, Science Fairs and Science Safety Biological Descriptions of Disabilities <u>Learning Cycle Science Lesson: Group 3-Oceans</u>	Ch. 16	Reading Response
Nov. 22 Holiday				
14	Nov. 29	Science News, Science Tips, Teaching Tips National Science Education Standards <u>Learning Cycle Science Lesson: Group 4-Plants/Animals</u>	Ch. 17, 18	Reading Response
15	Dec. 6	Science News, Science Tips, Teaching Tips Biological Descriptions of Disabilities Unit Presentations <u>Learning Cycle Science Lesson: Group 5- Nutrition/Fitness</u>	Ch. 19	Reading Response
16	Dec. 13	Unit Lesson		Unit Lesson

Criteria for Grading Assignments

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

COURSE ASSIGNMENTS

1. Reading Responses (due for each chapter)	15%
2. Science Classroom Questionnaires-beginning and end of class	10%
3. Class Project Directorship	10%
4. Web Sites and Lessons	10%
5. CA Science Content Standards Activity	10%
6. Leadership of Hands-on Science Lessons (two group lessons)	15%
7. Science Activity and Poster for Elementary School Science Exposition	10%
8. Science Teaching Unit	20%

Late assignments will be penalized by a 10-point reduction each day they are late.

ASSIGNMENT DESCRIPTIONS**1. READING RESPONSES (ONE PER CHAPTER)**

Students will be assigned readings and should present their responses to each chapter in one of the following forms:

- a Big Ideas paper explaining the key science concepts and example activities
- a visual or symbolic representation of the key science concepts
- a graphic organizer that demonstrates the key science concepts and their relationships to one another (samples will be provided in class)

The responses should be 1-2 pages. They may be typed or handwritten, but must be legible. They will be checked off for completion each due date, noted in the course outline. Representative samples will be examined for closer reading.

Key skills/knowledge:

For Ch. 1-2, summarize the information.

Beginning with Ch. 3 write about the science content, not the activities.

At what level have you comprehended the science content?

Is your work a summary of the science content presented?

2. SCIENCE CLASSROOM QUESTIONNAIRE

You will complete a science classroom questionnaire at the beginning of class, based on your current ideas. Then you will complete one again at the end of the class to demonstrate how your thinking has changed.

3. CLASS PROJECT DIRECTORSHIP

We operate under the philosophy that classes should be driven by “real work” in the “real world” rather than just assignments. The following represent a sample of job descriptions used and will focus on one class project task undertaken for class project directorships.

- 1 Group Coordinator of Science Lessons
This person will serve as coordinator of the “Hands-On Science Lessons” that will be led in class by groups of students. Each group 4-5 students will lead 2 Lessons. The coordinator will keep a list of the topics and titles of the Lessons and the days each group is presenting.
- 2 Celebration Coordinator
This person will keep track of dates and events (including birthdays) that are important for the members of the class, their families and careers. During our class, the Celebration Coordinator will announce dates and events, and ensure that we honor them in appropriate fashion.
- 3 Course Assignment Reporter
This person will remind classmates of assignment details and due dates.
- 4 Class Photographer/Liaison with the Professor
This person will take a picture of each student in the class.

Students may want an instructor to know something, but may not want to say it. The class liaison will bring important information to the attention of the instructor, and will also take information back to students. The decision as to whether or not to take particular information to the professor will be made by the liaison, at his or her own discretion.
- 5 Room Coordinator
This person will erase boards and place furniture in preferred room arrangement at the beginning and end of each class, and will perform tasks to make the learning environment more comfortable.
- 6 Public Relations Officer
This person will create at least one news release (related to class activities) and picture for publication and take it to the COE Field Experience Office and the campus newspaper office.
- 7 Newspaper Science Researcher 1
At the beginning of every other class, this person will share a news article pertaining to science.
- 8 Newspaper Science Researcher 2
At the beginning of every other class, this person will share a news article pertaining to science.
- 9 Science-of-the-Day tip 1
At the beginning of every other class, this person will share a “science of the day” tip.
- 10 Science-of-the-Day tip 2
At the beginning of every other class, this person will share a “science of the day” tip.
- 11 Teaching Tip 1
At the beginning of every other class, this person will share a tip on science teaching strategies.
- 12 Teaching Tip 2
At the beginning of every other class, this person will share a tip on science teaching strategies.
- 13 School Science Exposition Coordinator
This person will coordinate activities, and keep track of who-is-doing-what for the Elementary School Science Exposition. This person will also visit the school prior to the Exposition and provide written directions.
- 14 Student Folder Coordinator 1
This person will set out student folders prior to class, and collect them 5 minutes after class begins.
- 15 Student Folder Coordinator 2
This person will collect them 5 minutes after class begins.

4. WEB SITES AND ASSIGNMENT

For this assignment, we will visit the World Wide Web using Netscape. Each student find 5 web sites of science activities and type short summaries of what the web sites offer. Additionally, each student will print 5 science lessons from the Web. You may work in groups, but each student must turn in different science lessons and summaries of different web sites.

Rubric for Web Sites

Topic (something you'd like to teach) that your web sites/lessons focus on

Include a copy of Web site descriptions, Web site Lessons

Score Criteria	Quality of Work		
<u>Web Sites</u>	Included Web address, title and summaries describing 5 web sites for teaching a unit focusing on one topic 50 pts.	Included Web address, title and summaries describing 3 web sites for teaching a unit focusing on one topic 25 pts.	Included Web address, title and summaries describing 1 web site for teaching a unit focusing on one topic 5 pts.
<u>Printouts of Lessons</u>	Included printouts of 5 lessons appropriate for elementary teaching of a unit. 50 pts.	Included printouts of 3 lessons appropriate for elementary teaching of a unit. 25 pts.	Included printouts of 1 lessons appropriate for elementary teaching of a unit. 5 pts.

5. CA SCIENCE CONTENT STANDARDS ACTIVITY

Using the CA Science Content Standards for the grade level in which you will be doing your advanced student teaching, each student will prepare a unit outline for that grade level. The outlines will include

1. Complete science content standards addressed in the unit.
2. List and definitions of key science concepts in the unit.
3. Brief Descriptions of 3 lessons.
4. Each lesson description should the following:
 - a. Science content background for the lesson
 - b. Learning objectives
 - c. Brief description of hands-on science activities to teach the objects
 - d. Assessments

Content Standards Assignment Rubric

Score	Criteria	Quality of Work		
_____	<u>Content Standard</u>	Complete science standard(s) are listed. 20 pts.	Standards are incomplete. 5 pts.	Standards are not addressed. 1pt.
_____	<u>Science Concepts</u>	New Science Concepts are listed and defined. 20 pts.	New science concepts are poorly defined. 5 pts.	Science concepts are incomplete or incorrectly defined. 1 pt.
_____	<u>Lesson 1</u>	Science Background –5pts. Complete behavioral objectives-5 pts. Science Activity –5pts. Assessment measures-objective/authentic-5 pts. Total 20 pts.	Some components are addressed. Total 10 pts.	Components are not addressed. Total 1 pt.
_____	<u>Lesson 2</u>	Science Background –5pts. Complete behavioral objectives-5 pts. Science Activity –5pts. Assessment measures-objective/authentic-5 pts. Total 20 pts.	Some components are addressed. Total 10 pts.	Components are not addressed. Total 1 pt.
_____	<u>Lesson 3</u>	Science Background –5pts. Complete behavioral objectives-5 pts. Science Activity –5pts. Assessment measures-objective/authentic-5 pts. Total 20 pts.	Some components are addressed. Total 10 pts.	Components are not addressed. Total 1 pt.

6. LEADERSHIP OF HANDS-ON SCIENCE LESSONS (TWO GROUP LESSONS)

You will work in groups of 3 people to lead science lessons based on the Learning Cycle Model of Instruction. You will teach these to your classmates. Each lesson will be allocated a maximum of 30 minutes of class time to teach. The class will not role-play elementary students, but will learn the science content and how to teach it. Treat your classmates as teachers, not elementary students.

The lessons should include hands-on lessons, and should emphasize particular science concepts. The Exploration and Application phases of the Learning Cycle must require different hands-on science activities using manipulatives. 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.

Be sure you understand the concepts you are emphasizing, and that you can explain them. The lessons should be developmentally appropriate for K-6, and should follow the NSTA Safety Guidelines.

Make sure that you include the 3 stages of the Learning Cycle.

Make sure that science content background is addressed.

You need to explain SDAIE strategies to highlight with this lesson to meet the learning needs of children whose first language is not English.

End the lesson with a discussion about applications of this science content in everyday life.

Each group will prepare a handout that includes the 3 stages of the learning cycle, a summary of the science content background, SDAIE strategies, and applications to everyday life. Bring copies of the activity (for everyone) with (a) group members’ names at the top and (b) reference at the bottom. *On the first line, write out the science concept(s) you are teaching in a complete sentence. Do not say, “The students will ____.” (That is an objective, not a science concept.)*

Each group will prepare an evaluation instrument to be used by (a) the instructor, (b) 5 class members not in the group, (c) group members (each will complete one copy). The evaluation instruments should have the group member’s names, title and science topic at the top. The instructor’s copy should include a description of each person’s role in researching and presenting.

Rubric for Leadership of Hands-On Science Lessons

Score Criteria	Quality of Work				
<u>Timeline</u>	Completed all 3 stages of the Learning Cycle. 10 pts.	Completed 2 stages of the Learning Cycle. 7 pts.	Completed 1 stage of the Learning Cycle. 4 pts.	Completed 0 stages of the Learning Cycle. 1 pt.	
<u>Exploration</u>	All students participated in a developmentally appropriate hands-on science activity, made observations, and collected data. 10 pts.	Some students participated in a developmentally appropriate hands-on science activity, made observations, and collected data. 7 pts.	A minimal number of students participated in a hands-on science activity, made observations, and collected data. 4 pts.	None of the students participated in a hands-on science activity, made observations, and collected data. 1 pt.	
<u>Materials</u>	Materials were provided so that all students could easily participate. 10 pts.	Materials were provided so that some students could easily participate. 7 pts.	Materials were provided so that a few students could easily participate. 4 pts.	Materials were provided so that one student could easily participate. 1 pt.	
<u>Concept Invention</u>	Students shared their observations, data and explanations. Teacher provided further explanations and terminology, and tied it all together. 10 pts.	A minimum of student sharing and explaining occurred. Teacher provided some explanation. 7 pts.	No student sharing occurred. Teacher provided all explanations. 4 pts.	No student sharing occurred. Little teacher sharing occurred. 1 pt.	
<u>Concept Application</u>	All students participated in a developmentally appropriate hands-on science activity, made observations, and collected data. 10 pts.	Some students participated in a developmentally appropriate hands-on science activity, made observations, and collected data. 7 pts.	A minimal number of students participated in a hands-on science activity, made observations, and collected data. 4 pts.	None of the students participated in a hands-on science activity, made observations, and collected data. 1 pt.	

	<u>Science Content Background</u>	Your team provided a thorough explanation of the science content background. 10 pts.	Your team provided a very short explanation of the science content background. 7 pts.	Your team provided an incomplete explanation of the science content background. 4 pts.	Your team provided a poor explanation of the science content background. 1 pt.
	<u>SDAIE Strategies</u>	Numerous (5-6) SDAIE strategies are explained. 10 pts.	3-4 SDAIE strategies are explained. 7 pts.	1-2 SDAIE strategies are explained. 4 pts.	One SDAIE strategy is explained. 1 pt.
	<u>Applications to real life</u>	Numerous applications to everyday life are described. 10 pts.	A few applications to everyday life are described. 7 pts.	A couple of applications to everyday life are described. 4 pts.	One application to everyday life are described. 1 pt.
	<u>Handout</u>	Handout included science concept definition, 3 stages of Learning Cycle, science content background, SDAIE strategies, applications to real life, and references. 10 pts.	Handout included 5 or 6 of the 7 components. 7 pts.	Handout included 3 or 4 of the 7 components. 4 pts.	Handout included 1 of the 7 components. 1 pt.
	<u>Science Concept Explanation</u>	Demonstrated a correct and thorough understanding of the science concept you were teaching. 10 pts.	Demonstrated some understanding of the science concept you were teaching. 7 pts.	Did not demonstrate a correct and thorough understanding of the science concept you were teaching. 4 pts.	Demonstrated a very poor understanding of the science concept you were teaching. 1 pt.

7.SCIENCE ACTIVITY/POSTER FOR ELEMENTARY SCHOOL SCIENCE EXPOSITION

You will prepare a hands-on science activity and poster about a science concept. You will present the activity at our Elementary School Science Exposition. 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.

You should type the activity to turn in. Include your name at the top of the page and references at the bottom of the page. *****On the first line of the activity, write out the science concept(s) you are teaching in a complete sentence. Do not say, “The students will ____.” (That is an objective, not a science concept.)*****

The lessons should include hands-on lessons, and should emphasize particular science concepts. The Exploration and Application phases of the Learning Cycle must require different hands-on science activities using manipulatives. 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.

Everyone must choose a difference science concept to teach. You may choose one that your group led in class for our hands-on science activity.

Rubric for Activity, Poster and Presentation-Elementary School Exposition

Note: Plan on about 12 minutes to present this lesson to each group of 4 students. Please use the Learning Cycle, and include a mini-exploration, concept invention and application activity.

Score	Criteria	Quality of Work			
_____	<u>Lesson Description</u>	Activity is typed with (a)science concept, (b)materials, (c)procedures, (d)explanation, & (e)resources. 14 pts.	Four of the five components are present. 11 pts.	Three of the characteristics are present. 8 pts.	Two of the characteristics are present. 5 pts.
_____	<u>Visual Display</u>	3 sided visual display shows great creativity and is thought provoking. Demonstrates concept graphically. 14 pts.	3 sided visual display shows creativity and thoughtfulness; has graphics or pictures. 11 pts.	3 sided visual display shows some thoughtfulness and creativity, but does not cause one to take a second look. 8 pts.	Visual display is present, but required little imagination or creativity. 5 pts.
_____	<u>Science Concept</u>	Science concept is correctly defined in a complete sentence. 14 pts.	Science concept is poorly defined or is correctly defined, not in sentence. 11 pts.	Science Concept is poorly defined in an incomplete sentence. 8 pts.	Science Concept is not defined. 5 pts.
_____	<u>Materials</u>	You have the necessary materials for all students to participate in the hands-on lesson. 14 pts.	You have most of the necessary materials for all students to participate in hands-on lesson. 11 pts.	You have a few of the necessary materials for all students to participate in hands-on lesson. 8 pts.	You have the necessary materials for one student per group to participate in hands-on lesson. 5 pts.
_____	<u>Exploration Science Activity</u>	Activity is (a)hands-on, (b)developmentally appropriate, & (c)feasible for all students. 14 pts.	Two of the 3 characteristics are present. 11 pts.	One of the characteristics is present. 8 pts.	Teacher does a hands-on activity for students. 5 pts.
_____	<u>Concept Invention</u>	Students shared observations, data and explanations. Teacher provided further explanations and terminology, and tied it all together. 14 pts.	A minimum of student sharing and explaining occurred. Teacher provided some explanation 11 pts	No student sharing occurred. Teacher provided all explanations. 8 pts.	No student sharing occurred. A little teacher sharing occurred. 5 pts.
_____	<u>Concept Application Science Activity</u>	Activity is (a)hands-on, (b)developmentally appropriate, & (c)feasible for all students. 14 pts.	Two of the 3 characteristics are present. 11 pts.	One of the characteristics is present. 8 pts.	Teacher does a hands-on activity for students. 5 pts.

8. SCIENCE TEACHING UNIT

You will create a unit on a specific science topic. You must bring a stamped, self-addressed manila envelope in order to receive a final grade. The grade will be determined by the unit plan, lessons and your final presentation.

1. Unit Plan (1 page-include title, grade level, goals for unit, one-two line descriptions of each lesson)
2. 3 Learning Cycle Lesson Plans *Adapt from Commercial Lessons!*
For each lesson, include the following: *Do not re-invent activities.*
 - a. Topic
 - b. Science Concept --Write out the science concept(s) you are teaching in a complete sentence. Do not say, “The students will ____.” (That is an objective, not a science concept.)
 - c. Objectives (1-2) (use behavioral objectives with action verbs—i.e., The students will ____)
 - d. Exploration Activity- explain what students will do and what teacher will do
 - e. Concept Invention Activity --explain what students will do and what teacher will do
 - f. Concept Application Activity- explain what students will do and what teacher will do
3. SDAIE Strategies –explanation of SDAIE strategies included and how they are used
4. Science Themes -explanation of science themes included and how they are emphasized
5. Science Process Skills – explanation of science process skills used and how they’re used
6. Description of an Activity Center to go with Unit
7. Description of 3 Alternative Assessments for the Unit
8. Description of Final Project for Unit
9. References

The lessons should include hands-on lessons, and should emphasize particular science concepts. The Exploration and Application phases of the Learning Cycle must require different hands-on science activities using manipulatives. 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.

Science Teaching Unit Rubric

Topic _____ *To receive a grade, turn in a stamped, self-addressed manila envelope with unit.*

Score **Criteria** **Quality of Work**

_____	<u>Science Concept</u>	Science concept is correctly defined in a complete sentence. 7 pts.	Science concept is poorly defined or is correctly defined, but not in a complete sentence. 5 pts.	Science concept is poorly defined in an incomplete sentence. 3 pts.	Science concept is not defined. 1 pt.
_____	<u>Objectives</u>	One-two behavior objectives with action verbs are written in complete sentences. 7 pts.	Behavioral objectives are poorly written. 5 pts.	Objectives are not behavioral objectives. 3 pts.	Objectives are absent. 1 pt.
_____	<u>Exploration</u>	All students participate in developmentally appropriate hands-on science activities, make observations, and collect data in 3 lessons. 7 pts.	Some students participate in developmentally appropriate hands-on science activities, make observations, and collect data in 3 lessons. 5 pts.	Students participate in hands-on science activities, make observations, and collect data in 2 lessons. 3 pts.	Few students participate in hands-on science activities, make observations, and collect data in lessons. 1 pt.
_____	<u>Concept Invention</u>	Students share their observations, data and explanations. Teacher provides further explanations and terminology, and ties it all together 7 pts.	A minimum of student sharing and explaining occurs. Teacher provides some explanation. 5 pts.	No student sharing occurs. Teacher provides all explanations. 3 pts.	No student sharing occurs. Little teacher sharing occurs. 1 pt.
_____	<u>Concept Application</u>	All students participate in developmentally appropriate hands-on science activities, make observations, and collect data in 3 lessons. 7 pts.	Some students participate in developmentally appropriate hands-on science activities, make observations, and collect data in 3 lessons. 5 pts.	Students participate in hands-on science activities, make observations, and collect data in 2 lessons. 3 pts.	Few students participate in hands-on science activities, make observations, and collect data in lessons. 1 pt.
_____	<u>SDAIE Strategies</u>	Numerous (5-6) SDAIE strategies are explained. 7 pts.	3-4 SDAIE strategies are explained. 5 pts.	1-2 SDAIE strategies are explained. 3 pts.	1 SDAIE strategy is listed. 1 pt.
_____	<u>Science Themes</u>	Your unit includes correct references to and definitions of relevant science themes and explanations of how they are emphasized. 7 pts.	Your unit includes science theme title(s) and definitions, but no explanations of how they are emphasized. 5 pts.	Your unit includes science theme title(s), but no definitions or explanations. 3 pts.	You included the name of one science theme. 1 pt.

_____	<u>Science Process Skills</u>	Your unit includes a list of the science process skills that students practice in the lessons and an explanation of when they use the skills. 7 pts.	Your unit includes a list of the science process skills, but little explanation of when students use them in the unit. 5 pts.	Your unit includes little information on the process skills. 3 pts.	The process skills are mentioned in your unit, but not explained. 1 pt.
_____	<u>Alternative Assessments</u>	Your unit includes a list of 3 alternative assessments and clear explanations of each. 7 pts.	Your unit includes a list of 3 alternative assessments, but it is not clear how they will be done or how they assess learning from the unit. 5 pts	Your unit includes a list of 2 alternative assessments and explanations. 3 pts.	Your unit includes a one alternative assessments and explanation. pt.
_____	<u>Activity Center</u>	Your unit includes a complete description of an activity center, including procedures to set it up, necessary components, and an explanation of what students will do and learn. 7 pts.	Your unit includes a description of an activity center, procedures and components, but little explanation of what students will do and learn. 5 pts	Your unit includes a description of an activity center, but few procedures, components or explanation of what students will do and learn. 3 pts.	Your unit includes the title of an activity center. 1 pt.
_____	<u>Final Project</u>	Your unit includes a description of a final, culminating project; description of how you will plan & make arrangements for it; and an explanation of how it ties the unit together. 7 pts.	Your unit includes a description of a final project and planning information, but no explanation of how the final project ties the unit together. 5 pts	Your unit includes a description of a final project, little planning information and little explanation of how it ties the unit together. 3 pts.	Your unit includes a title of a final project. 1 pt.
_____	<u>References</u>	Your unit includes complete references you used from other sources. 7 pts.	Your unit includes a list of references, but not complete information. 5 pts	Your unit includes very little reference information. 3 pts.	Only reference titles are included. 1 pt.
_____	<u>Presentation</u>	Your presentation was outstanding and followed the guidelines for presentations. Your explanations showed evidence of a thorough understanding of the topic and teaching applications. 14 pts.	Your presentation was well done, followed some of the guidelines for presentations, and showed that you had an understanding of most aspects of the topic and teaching applications. 10 pts.	You followed a few of the guidelines for presentations. There was some evidence of planning and practice You had a limited understanding of the topic and teaching applications. 6 pts.	You did a presentation, but there was little evidence of planning, practice and understanding of the topic. 2 pts.

Course Grades

An “A” student is one who:

- completes all assignments on time and demonstrates the ability to summarize, analyze, and/or reflect at high levels.
- varies sources of information for assignments, demonstrating high degree of effort in pursuing varied perspectives around important educational issues.
- completes all the reading assignments and develops thoughtful and thorough responses.
- produces work that reveals a strong commitment to self-discovery and learning.
- produces work at a high professional level in terms of both writing and content.
- develops a high quality presentation, demonstrating significant learning around a contemporary issue.
- presents confidently and intelligently, demonstrating effective teaching skills.
- completes assignments in/out of class with a focus on learning and exploration, pushing him/herself to better understand the profession through quality work.
- attends almost every class meeting and is fully engaged during class.
- pushes him/herself to new understandings by participating in discussions, sharing his/her opinions, and valuing others’ perspectives.
- contributes to the positive environment of the class by respecting all members.

A “B” student is one who:

- completes all or almost all assignments, all or most on time, and demonstrates the ability to summarize, analyze, and/or reflect at fairly high levels, showing consistent improvement over time.
- varies sources of information for assignments, demonstrating high degree of effort in pursuing varied perspectives around important educational issues.
- completes all or most of the reading assignments and develops thoughtful and fairly thorough responses.
- produces work that reveals a commitment to self-discovery and learning.
- produces work that is close to professional level in terms of both content and writing, working to develop a strong command of writing, speaking, planning and presenting.
- develops presentations, demonstrating significant learning
- presents confidently and intelligently, demonstrating effective teaching skills.
- completes assignments in/out of class with a focus on learning and exploration, pushing him/herself to better understand the profession through quality work.
- attends almost every class meeting and is regularly engaged during class.
- pushes him/herself to new understandings by participating in discussions, sharing his/her opinions, and valuing others’ perspectives.
- contributes to the positive environment of the class by respecting all members.

A “C” student is one who:

- completes or attempts most of the assignments, mostly on time, and demonstrates the ability to do some quality summarizing, analysis, and reflection, showing improvement over time.
- varies sources of information for assignments, demonstrating effort in pursuing varied perspectives around important educational issues.
- completes most of the reading assignments and develops thoughtful and sometimes thorough responses.
- produces work that reveals a commitment to some self-discovery and learning.
- produces work that is not yet at a professional level in terms of both writing and content.
- develops a quality presentation, demonstrating learning around a contemporary issue.
- presents confidently and intelligently, demonstrating some effective teaching skills.
- completes assignments in/out of class with a focus on learning and exploration, pushing him/herself a little to better understand the profession.
- attends most class meetings and is often engaged during class.
- pushes him/herself to some new understandings by participating to a moderate degree in discussions, sharing his/her opinions, and valuing others’ perspectives.
- contributes to the positive environment of the class by respecting all members.

A “D” student is one who doesn’t meet all of the minimal standards of a “C” student; “F” is earned by someone who hasn’t completed significant portions of the required work and fails to meet the “C” student standards.

Journals

Science	School Science and Math
Science and Children	Innovations in Science and Technology Education
Science Education	Journal of Research in Science Teaching
Science News	American Biology Teacher
Science Scope	Physics Teacher
The Science Teacher	Journal of Chemical Education

Visit <http://enc.org> to see the new web site of Eisenhower National Clearinghouse

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.

Lastly, visitors will find news and timely information about workshops, student contests, awards and grants, and other developments in math and science education.