EDMS 545: Science Education in the Elementary School
California State University San Marcos
SPRING 2002

Class Meetings: Thursday (6:00-8:45 PM)

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The Mission Statement of the College of Education, CSU San Marcos

The mission of the College of Education Community is to transform public education by preparing thoughtful educators and advancing professional practices. We are committed to the democratic principles of educational equality and social justice for all learners, exemplified through reflective teaching, learning, and service. We value diversity, collaboration, professionalism, and shared governance.

CLAD Infusion

In 1992, the College of Education voted to infuse Crosscultural, 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.

Required Textbooks:

Teaching Children Science. An Inquiry Approach. By Alfred E. Friedl. NY: McGraw-Hill.

EDMS 545 Science Education Course Handouts. Kathy Norman

Recommended : Books:

Science Framework for California Public Schools. (1990). Developed by the Science Curriculum Framework and Criteria Committee. Sacramento. CA Dept. of Education.

Other Good Books:

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

200 Gooey, 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. Check 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. This class requires participation/observation in the public schools. 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:

- Demonstrate proficiency with inquiry skills of observing, measuring, inferring, classifying, predicting, verifying predictions, hypothesizing, isolating variables, interpreting data, and experimenting.
- Identify exemplary materials (curriculum kits, science programs, textbooks, equipment, technology, ancillary materials) appropriate for elementary school children.
- 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.
- Use the Learning Cycle model of instruction to teach science in a contemporary manner.
- Use telecommunications and other forms of technology in elementary science teaching.
- Demonstrate confidence in leading and performing investigations designed to teach science concepts, science process skills, and scientific attitudes.
- Use alternative methods of assessment to evaluate student learning of science concepts and processes.
- Design a 3-lesson elementary science teaching unit .
- Strategies to include all students in science (linguistically and culturally diverse, students with disabilities and other students with special needs.
- Demonstrate knowledge and understanding of the National Science Education Standards and California Science Content Standards.

COURSE REQUIREMENTS

College of Education 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. Absences and late arrivals/early departures will affect the final grade. **If you miss two class sessions or are late (or leave early) for more than three sessions, you cannot receive a grade of A or A-. If you miss 3 class sessions, your highest possible grade is a C+.** COE attendance policy states, "At a minimum, students must attend 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 students have extenuating circumstances, please contact the instructor as soon as possible. Absences do not change assignment due dates.

Professionalism: It is expected that students will come to class prepared to discuss the readings, submit required assignments, and participate in class activities. Teacher education is a professional preparation program. Students will be expected to adhere to academic honesty and integrity, standards of dependability, confidentiality and writing achievement. Because it is important for teachers to be able to effectively communicate their ideas to students, parents, colleagues, and administrators, writing that is original, clear and error-free is a priority for the College of Education. It is expected that work will be turned in on time. Late work will affect the student's grade in the course and will not be accepted after a week. Please discuss individual issues with the instructor.

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 join now!

Assignment Descriptions

Reading Responses (due for each chapter) **20 pts.**

Students will be assigned readings and should present their outline of the content to each chapter in both of the following forms:

- A Big Ideas paper explaining the key science concepts (linear outline).
- A graphic organizer that demonstrates the key science concepts and their relationships to one another (samples will be provided in class).

The responses may be typed or handwritten, but must be legible. These responses may be the basis for in-class discussion with your colleagues. I will check them off for completion in class each meeting and collect representative samples for closer reading.

Class Project Directorship (Class Jobs) **5 pts.**

We operate under the philosophy that classes should be driven by "real work" in the "real world" rather than just assignments. Each student will sign up for a Class Directorship and points given will be based upon the completeness to which the student accomplishes their job. See Directorship Descriptions Handout.

Science Instruction Case Study **15 pts.**

Students will develop a case study of science instruction involving input from classroom observations, a K-8 teacher or teachers and K-8 students. In this assignment you will develop a case study of science instruction. It consists of four parts:

1. Ask an elementary teacher if you can observe science lessons in his or her class. Then answer the following:
   a. How would you define science instruction in this classroom? What are the characteristics of science instruction? What does the teacher do during science instruction? What do the students do during science instruction? What materials are used?
   b. How often do the students engage in hands-on activities? Do they each participate and have a role?
   c. How is the classroom organized for science instruction? What science materials are in the classroom? What evidence is there of science?
   d. Do you see writing infused within the science lessons? If so, what are some examples?
   e. Are their children in the class who are learning English? What differences and similarities exist for children who are learning English?

   Feel free to add more descriptive information that you find out about your classroom in regard to literacy instruction.

2. After you have answered the above questions find time to interview the teacher, using the following questions.
   a. How do children learn science? How do you organize instruction so that children learn concepts related to the California science standards? What

are the different activities that you do during science instruction? How do you group the students during science activities?

b. How often do you teach science? How often do the children participate in hands-on science activities?
c. Do you integrate writing activities into science lessons? What are some examples?
d. What is the easiest thing about teaching science? What is the most difficult thing about teaching science? If you could design the ideal science program, what would be the characteristics of the program?
e. How do you organize instruction for science in two languages or in a language other than English? What challenges does this present for you?
f. How do you adapt instruction for students with special needs? Are their particular techniques or issues related to science teaching and students with special needs?

Feel free to include other questions during the interview. If possible, take a portable tape recorder to record the responses for later transcription as it is easy to miss some things when you are taking notes. Be sure to ask the teacher if she or he minds if you use the tape recorder, and do not use it if the teacher is hesitant.

3. Ask the teacher if you can hand out the Science Survey to the students in the class. Do not have the students put their names on the surveys. Feel free to include other questions on the survey, but do not make it too long for the student to answer. This survey will work with third graders and up; you can try it with second graders but I would suggest reading the questions aloud one at a time for them. If you are working with K, 1 or 2 use the following alternative strategy: Choose approximately 6 students (if you are in a bilingual class choose 3 who have English as their native language and 3 with Spanish or whatever other language is spoken in the class). Interview each student using the survey questions. Record the answers, if possible, and transcribe the taped interviews.

4. Examine the three sets of data (your responses, those of the teacher and students) for matches and mismatches. You might want to make a grid to organize the data:

	Me	**Teacher**	**Students**
How is science taught?			
How does the teacher teach science?			

Do the students participate in hands-on science activities?			
Adaptations and Accommodations			

Use whatever categories or questions that seem relevant in the left hand column in order that you may compare and contrast the three points of view regarding science instruction.

Using the data you have collected and the match/mismatch chart, type a 2-3 page case study of the science instruction. Turn in your case study along with all surveys, interviews and your own answers to questions.

Teaching of Hands-on Science Lessons (two group lessons) **20 pts.**

You will work in groups 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 45 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. You must complete the Exploration and Concept Introduction (Invention) phases during the 45 minutes.

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.

- One person will be responsible for leading the Exploration phase of the lesson.
- One person will lead the Concept Introduction (Invention) phase of the lesson, and will explain the science content background for the activity.
- One person will lead the Concept Application activity.
- One person will explain SDAIE strategies to include with this lesson to meet the learning needs of children whose first language is not English.
- One of the group members will lead a discussion about applications of this science content in everyday life.
- Each group will prepare a handout which 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 group members' names at the top and references at the bottom of the page. On the first line of the handout, write out the science concept(s) you are teaching in a complete sentence. The second line should state the behavioral objective.

Topic Assignments for groups:

Group 1 – Chapters 6 and 13	Group 4 – Chapters 10 and 16
Group 2 – Chapters 8 and 14	Group 5 – Chapters 11 and 19
Group 3 – Chapters 9 and 15	Group 6 – Chapters 12 and 20

Science Activity and Poster for Elementary School Science Fair **10 pts.**

You will work with a partner and prepare a hands-on science activity and poster about the activity. You and your partner will present the activity at our Elementary School Science Fair. Your activity should emphasize a particular science concept(s). Be sure you understand the concept(s) you are emphasizing, and that you can explain it. The activity should be developmentally appropriate for K-6, and should follow the NSTA Safety Guidelines.

You will type the activity to turn in **before the event**. 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. On the second line, state the behavior objective for the lesson/activity.

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 Mini-Unit **20 pts.**

You will create a unit on a specific science topic. It is important to consider teaching something that will fit into what your master teacher has planned in his/her curriculum. Please discuss what topics your MT has planned during your time there, and plan around that so you will be able to teach what you will have worked so hard on! Your grade will be based on the following components:

A. Unit Plan: 1 page - include title, grade level, goals for the unit, one-two line descriptions of each lesson.

B. 3 Learning Cycle Lesson Plans - Adapt from Commercial Lessons! Do not re-invent activities. For each lesson, include the following:

- Topic
- Science concept(s) taught in the lesson stated in a complete sentence.
- Objectives (use behavioral objectives with action verbs - i.e. The students will __).
- Exploration Activity - Explain what the students will do.

- Concept Introduction Activity - Explain what students will do and what the teacher will do.
- Concept Application Activity - Explain what students will do and what the teacher will do.
- SDAIE Strategies - Explanation of SDAIE strategies included and how they are used.
- Science Themes - Explanation of science themes included and how they are emphasized.
- Science Process Skills - Explanation of science process skills used and how they're used.

C. Description of an Activity Center to go with Unit
D. Description of Final Project for Unit
E. References

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

Take Home Final **10 pts.**

This assignment will be given in class prior to your student teaching, to be completed and turned in by the last class. It will include 4 questions.

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%

Resources

Journals

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

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.