

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 Gooey, 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.

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.

ASSIGNMENT DESCRIPTIONS

1. Professionalism – 10%

Students will engage in active learning each class session, and will be expected to actively participate, collaborate, and demonstrate professionalism at all times. The following questions will be used as a rubric to measure your professional conduct.

- Do you participate in class discussions productively, sharing your knowledge and understandings?
- Do you interact productively with your peers, taking on a variety of roles (leader, follower, etc.)?
- Do you contribute appropriately to group work—do you “do your share”?
- Are you able to accept others’ opinions?
- Are you supportive of others’ ideas?
- Do you support your peers during their presentations?
- Can you monitor and adjust your participation to allow for others’ ideas as well as your own to be heard?
- Do you show a positive attitude and disposition towards teaching all students?
- Do you exhibit professional behavior at all times?
- Do you attend each and every class, arrive on time and well prepared in all aspects, and do not ever leave early?
- Do you give close attention to each activity and speaker, and never whisper or do other things while there is a speaker?

2. DISCUSSION QUESTIONS: (Based on Readings from the two required text readings) - 15%

Each student will be required to submit a discussion question for the class based on the readings of the assigned chapters from the books: *Cases in Middle and Secondary Science Education and Teaching Children Science*. The questions should be submitted to the instructor via email by **noon** the day of the class for which the readings are assigned. 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 LEARNING CYCLE SCIENCE LESSON (25%) (May work in teams of three)

You will work in groups of 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 45 minutes of class time to teach their lesson. Use activities from the textbook, Internet sites or other science resources. Team should teach the lesson as you would to middle level students.

Each group will be assigned a different chapter from the textbook. This will determine the grade level and California Science Standard your lessons will cover. The group will work together reviewing each other's lessons, 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. Lesson presentation

Each team will present a Learning Cycle Lesson, which includes a PowerPoint presentation during the Concept Invention phase.

Part II The group will share, web sites and/or other resources teachers would find helpful in presenting the standard. 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.

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. 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 another hands on activity. (see rubric for details)

Resources from the Internet are a required part of Concept Invention Phase. Images, movies, simulations, sounds, and other exciting resource are available free over the Internet. Students are responsible for emailing the instructor a PowerPoint presentation for the Concept Invention Phase part of your lesson. The PowerPoint can only be emailed or brought in on a CD. Keep the PowerPoint relatively simple; don't add bells and whistles that take away from the content.

Be sure you understand the concepts you are teaching, and that you can explain them. The lesson should be developmentally appropriate for middle level and should follow the NSTA Safety Guidelines.

Make sure that you include the three stages of the Learning Cycle and science content background is addressed.

Part II. Share a description of website 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.

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 (a) group members' names at the top

4. Science Lesson Reflection – 5% (Individual assignment)

Use your lesson from Leadership of Hands-on Science lesson. After presenting it to your classmates and/or children modify the lesson to reflect changes you made to improve it. Include a reflection on how the lesson went and why you think the changes are necessary. One page only. Turn in your reflection together with the lesson plan during the next meeting.

5. Interviewing with a child/teaching – 40%

In this three-part assignment, you will first plan to conduct an interview with an elementary school student to gather an understanding of the student's prior knowledge of "forces and motion". Once you have designed your interview, and after you have received feedback from your instructor, you will then conduct your interview. You will use your interview to identify your student's conceptions of force and motion. You will then design a brief 5-E format lesson to remediate some aspect of your student's alternate or incomplete conceptions. Finally, after receiving feedback on your lesson plan, you will present your lesson and analyze its effectiveness. By taking part in this process, you will be gaining important practical experience in developing questioning and teaching strategies, skills that are the hallmark of exemplary teaching!

See the appendix for details

6. SCIENCE TEACHING NOTEBOOK – 5% (individual): An electronic Notebook will be accepted if you can get all the items at one place)

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.

- I. California Science Content Standards for grades K-8 (download from <http://www.cde.ca.gov/board/pdf/science.pdf> and print)
- II. Discussion Questions for each class discussion
- III. Learning Cycle Lessons presented in class
 - a. Lesson Plan Handout
 - b. Individual lesson reflections – (What would you modify in order to teach the lesson)
- IV. Interview with a child/Teaching Tasks
- V. Other Class Handouts

SCIENCE METHODS GRADESHEET

<u>Assignments Grade</u>	<u>Percent of Grade</u>	<u>Your Grade</u>	<u>Points for Final</u>
1. Professionalism	10%	_____	x 0.10 = _____
2. Discussion Questions	15%	_____	x 0.15 = _____
3. Leadership of Hands-on Science Lessons	25%	_____	x 0.25 = _____
4. Science Lesson Reflection	5%	_____	x 0.05= _____
5. Interview with a Child/Teaching Assignment	40%	_____	x 0.40= _____
6. Science Teaching Notebook	5%	_____	x 0.05 = _____

FINAL GRADE = _____

Appendices
Appendix A: Interview Assignment

Introduction:

One of the most fundamental principles of teaching is to understand the capabilities and prior knowledge of the target learner: “Where are your learners at, and how far can you expect to go with them”. In this three-part assignment, you will first plan to conduct an interview with an elementary school student to gather an understanding of the student’s prior knowledge of “forces and motion”. Once you have designed your interview, and after you have received feedback from your instructor, you will then conduct your interview. You will use your interview to identify your student’s conceptions of force and motion. You will then design a brief 5-E format lesson to remediate some aspect of your student’s alternate or incomplete conceptions. Finally, after receiving feedback on your lesson plan, you will present your lesson and analyze its effectiveness. By taking part in this process, you will be gaining important practical experience in developing questioning and teaching strategies, skills that are the hallmark of exemplary teaching!

The conceptual topic of choice for this exercise is “forces and motion”. The topic is taught at all levels of elementary/middle school science instruction and is a central focus of both California and National science content standards. You might remember the topic from your physical science course as “Newton’s Laws of Motion”. It deals with such questions as:

1. What happens to a moving object if no forces act on it?
2. How does the motion or movement of an object change when it is pushed or pulled with some force?
3. How does an object respond when two or more forces push on it at the same time?
4. If all the forces pushing on an object cancel each other out, how will the object move?
5. What common situations in everyday life demonstrate forces existing as action/reaction pairs?

Interview with a Child/Teaching Assignment
EDMI 545: Methods of Teaching Elementary Middle School Science

General Direction Checklist:

- _____ 1. Follow the steps in Task #1: Outline for the Interview to develop a questioning strategy to probe for your student’s understanding of “forces and motion”.
- _____ 2. Identify a 4th - 8th grade elementary school student to interview. Please do NOT approach the cooperating teacher in your clinical class for help in finding a student to interview! You may interview children of friends and family, but keep in mind that you will have a more authentic experience if you are interacting with a child you do not know personally. Return the signed parental consent form to your instructor no later than **July 28**.
- _____ 3. Submit your completed Task #1: Outline for the Interview to your instructor via email no later than **July 28**. (*See task for email addresses and formatting instructions*)
- _____ 4. Once you have received final approval to proceed with your interview, you may proceed with the interview. Remember to make an audiotape of the interview.
- _____ 5. Use a word processing program to transcribe the interview verbatim.
- _____ 6. Follow the steps in Task #2: Preparing a Teaching Strategy to analyze your student’s prior knowledge of force and motion and prepare a teaching strategy.
- _____ 7. Submit your completed Task #2: Preparing a Teaching Strategy to your instructor via email no later than **August 4**. (*See the task for email addresses and formatting instructions*). Once you have received permission to proceed with your lesson you may move to the next step.
- _____ 8. Present your lesson 15-20 minute lesson to your elementary school student. Make an audiotape of the lesson.
- _____ 9. Transcribe the lesson verbatim.
- _____ 10. Follow the steps in Task #3: Analyzing the Teaching Session to evaluate your teaching session.
- _____ 11. Submit your completed task to your instructor via email no later than **August 11**.

Task #1: Outline for the Interview

1. It is expected that concepts are constructed by “building relationships between experiences”. As you detect relationships between more experiences, your conceptual understanding becomes deeper and deeper. Before you can get started thinking about what questions to ask in your interview, you first need to assess your own conceptual understanding of forces and motion. We have broken force and motion concepts into 5 general categories that are illustrated by these general questions:

- i) What happens to a moving object if no forces act on it?
- ii) How does the motion or movement of an object change when it is pushed or pulled with some force?
- iii) How does an object respond when two or more forces push on it at the same time?
- iv) If all the forces pushing on an object cancel each other out, how will the object move?
- v) What common situations in everyday life demonstrate forces existing as action/reaction pairs?

In order to assess your own conceptual knowledge of each of these categories, describe three or more cause/effect examples that illuminate your own personal conceptual understanding of each category. You may refer to any reference materials you have available to help find examples that are meaningful to you.

Note: Here is a sample set of examples a student might give for question #1: (your examples should be different than these)

- i) What happens to a moving object if no forces act on it?
 - a. If a bullet were shot in space, it would continue to move forever in a straight line at constant speed - never slowing down.
 - b. You are pulling a wagon that has a ball in it. If you suddenly stop the wagon, then the ball rolls forward in the wagon.
 - c. If you encounter an icy patch on a road just as you are entering a turn, your car will continue to move in a straight line instead of following the turn.
2. State the school and grade level of the child you will be interviewing. Provide definitions for any terms you used in your examples that a child at this grade level might not understand. Make sure each of your definitions uses only terms that a child at your target grade level would understand.
3. Create an essential list of basic facts or skills that would be required for your interviewee to understand each of the examples you described in item #1.
4. Create a set of very specific questions that probe for your interviewee’s understanding of the general concepts of force and motion. The questions must be suitable for your interviewee’s grade level. Try to relate your questions to objects and events that might be common to your interviewee’s everyday experience. For each of your questions, identify a corresponding category from item #1. Some questions may refer to more than one category. Some categories may be covered by more than one question. Make sure you have covered every category in your question set.
5. Compose a scientifically accurate response for each of your interview questions. Please cite at least 2 authoritative references that you used to compose your answers.
6. Rate and justify each of your questions on the Bloom’s Taxonomy 6 point scale.
7. Write a reflection paper on the process thus far. What have you learned from completing items 1-6? What problems do you anticipate when you conduct your interview? Are there any aspects of the exercise thus far which you have found particularly challenging? You may include whatever additional comments you like. Please be candid. **TASK #1 DUE DATE: July 28**

Task #2: Preparing a Teaching Strategy

Items:

1. Transcribe the audiotape of your interview using a word processor. Make sure you transcribe all of the interactions you had with your student during the interview verbatim. **Use a fictitious first name in place of the student's real name to protect his/her identity!!!!!!**
2. Provide a brief description of where the interview took place. Include the date, time, and place of the interview. (Remember, you are not to use a student from your clinical experience)
3. Discuss your effective or ineffective use of wait time, ordering of questions, phrasing/language of questions, and use of probing questions to gain further insight.
4. Write an analysis of your interview for areas of strength and questions that evoked better responses.
5. Write an analysis of your interview for areas of weakness with suggested changes.
6. Write an analysis of your student's conceptions of the concepts illustrated by the examples you chose in item #1 of Task 1. Include a discussion of points where the student's conceptual framework agreed and disagreed with accepted scientific explanations. Discuss factors in the prior experience of your student that could have influenced his/her responses. A significant degree of depth is expected in this part of the assignment.
7. Use your analysis of your student's conceptions to identify an appropriate conceptual difficulty to address in a 20-minute lesson. Precisely identify the concept you plan to teach in terms of cause/effect relationships. Present a rationale for choosing the target concept for your lesson using references or quotes from your interview to support your argument. (Keep in mind that you will only have 15-20 minutes to implement your lesson - so do not try to encompass too much information in your lesson!)
8. a) Describe the teaching strategy you plan to use in your lesson to remediate your student's alternate or incomplete conceptions.
b) Explain reasons why you expect your strategy to be effective.
c) Explain your strategy for assessing the degree to which your student has modified their alternate or incomplete conceptions.
9. Compose a 5-E learning cycle lesson for your 20-minute instructional intervention.
10. Write a reflection paper on the process thus far. What have you learned from completing items 1-9? What problems do you anticipate when you teach your lesson? Are there any aspects of the exercise thus far which you have found particularly challenging? You may include whatever additional comments you like. Please be candid.

TASK #2 DUE DATE: August 4

Task #3: Analyzing a Teaching Session

Items:

1. Transcribe the audiotape of your lesson using a word processor. Make sure you transcribe all of the interactions you had with your student during the lesson verbatim. **Use a fictitious name in place of the student's real name to protect his/her identity!!!!!!**
2. Provide a brief description of where the lesson took place. Include the date and time of the lesson and the name of your cooperating teacher.
3. Write an analysis of your teaching session for areas of strength.
4. Write an analysis of your teaching session for areas of weakness with suggested changes.
5. Write an analysis of student comprehension of your lesson. Include a discussion of points where the lesson succeeded, as well as where the lesson may have failed to achieve its goal. Present evidence from your transcript to support your conclusions.
6. If you were to continue to work with this student, describe how you might proceed with further instruction.
7. Reflect on the entire interview/teaching assignment. What did you learn from this experience? What would you have done differently? Were there any problems you did not anticipate? What did you find particularly challenging about the assignment? Share any comments that come to mind. Please be candid. Include as many comments as possible.

TASK DUE DATE: August 11

APPENDIX B:

Grading Scale for Interview with a Child/Teaching Assignment:

Task #1: Outline for the Interview

1. At least 3 examples are provided to illuminate each of the 5 categories of forces and motion concepts.	1 2 3 4 5
2. School and grade level of student are identified Any terms that a child at this level would not be familiar with are clearly defined.	1 2 3 4 5
3. Essential facts crucial to understanding examples are identified.	1 2 3
4. A set of interview questions is included which thoroughly encompasses the topic of forces and motion.	1 2 3 4 5 6 8 9
5. A scientifically accurate response is provided for each interview question. (sources cited)	1 2 3 4 5 6
6. Each question is rated and justified at a Bloom's Taxonomy level.	1 2 3 4 5 6
7. Reflections on interview preparation are included.	1 2 3 4
	TOTAL = _____ /40

Task #2: Preparing a Teaching Strategy

1. a) A full transcript of interview is included. b) A fictitious name for interviewee is used.	(Required) 16 1
2. A brief description of where the interview took place is provided.	1
3. A discussion of the use (effective or ineffective) of wait time, ordering of questions, phrasing/language of questions, use of follow-up questions to gain further insight is included.	1 2 3 4 5 6
4. An analysis of interview for areas of strength and questions that evoked better responses is included	1 2 3 4 5 6
5. An analysis of interview for areas of weakness with suggested changes is included.	1 2 3 4 5 6
6. Analysis paper on student conceptions of target concept: a) The analysis includes a discussion of points where the student's conceptual framework agreed with accepted scientific explanations.	1 2 3 4 5 6 1 2 3 4 5 6
b) The analysis includes a discussion of points where the student's conceptual framework disagreed with accepted scientific explanations. (Including incomplete frameworks)	1 2 3 4 5 6 8 9
c) The analysis includes a discussion of factors in the prior experience of the student that could have influenced his/her responses.	1 2 3 4 5 1 2 3 4 5 6
7.a) A targeted concept for a lesson is identified that addresses some alternate or incomplete conceptions found in the student's interview. b) A rationale for the choice of target concept is provided which includes appropriate references or quotations from the interview.	1 2 3 4 5 1 2 3 4 5 6
8. a) An appropriate teaching strategy is outlined. b) Reasons for expecting the strategy to be effective are included. c) A strategy for assessing the degree to which the student has modified their alternate or incomplete conceptions is described.	1 2 3 4 5 6 1 2 3 4 5 6 1 2 3 4 5 6
9. A 5-E learning cycle lesson is included	1 2 3 4 5 6
10. Reflections on preparing a teaching strategy is included.	1 2 3 4
	TOTAL = _____ /100

Task #3: Analyzing the Teaching Session

1. a) A full transcript of the lesson is included. b) A pseudonym for student is used.	(required) 10 1
2. A brief description of where the lesson took place is provided.	1
3. An analysis of teaching style for areas of strength is included.	1 2 3 4 5 6
4. An analysis of teaching style for areas of weakness with suggested changes is included.	1 2 3 4 5 6
5. Analysis paper on lesson: a) The analysis includes a discussion of points where the lesson succeeded in meeting its goals. b) The analysis includes a discussion of points where the lesson failed to meet its goals. c) Evidence from lesson transcript is used to support conclusions.	1 2 3 4 5 6 1 2 3 4 5 6 1 2 3 4 5 6
6. A description of hypothetical future lessons is included.	1 2 3 4 5 6
7. A candid reflection on the entire assignment is included.	1 2 3 4 5 6
	TOTAL = _____ /60

Comments:

APPENDIX C:
Rubric for Leadership of Hands-On Science Lessons

Concept _____

Name _____

Score	Criteria	Quality of Work			
_____	Lesson Plan Format	Lesson contained all sections. Very specific and detailed and easy to follow 5 pts.	Lesson contained all sections. Some details and easy to follow 4 pts.	Lesson contained all sections. Few details 2 pts.	Lesson missing sections. Not specific or detailed 1 pt.
_____	Technology	Used numerous visuals in Power Point presentation. Description of Five or more web pages connected to concept in handout. 10 pts.	Used some visuals in Power Point presentation. Description of four web pages connected to concept in handout 7 pts.	Used few visuals in Power Point presentation. Description of Three web pages connected to concept in handout 4 pts.	No visuals in Power Point presentation. Description of two or fewer web pages connected to concept in handout 0 pt.
_____	Exploration Activity	All students participated in a developmentally appropriate hands-on science activity, made observations, and/or collected data. Predictions are made before beginning activity. 10 pts.	Some students participated in a developmentally appropriate hands-on science activity, made observations, and/or collected data. Predictions are made before beginning activity. 8 pts.	A minimal number of students participated in a hands-on science activity, made observations, and/or collected data. No Predictions are made. 6pts.	None of the students participated in a hands-on science activity, made observations, and/or collected data. No Predictions are made. 0 pt.
_____	Exploration Phase	1. Lesson contains an activity-based exploration related to the question or problem that allows students to collect data or search for patterns. Three of Three Present 10pts.	2. Do Student's make predictions or theories elicited and discussed without being corrected? Two of Three Present. 8 pts.	3. Do students discuss what they observe, clarifying their observations and data with each other and the teacher? One of Three Present 6 pts.	None of the parts of an exploration phase present 0 pt.
_____	Concept Invention Phase	1. The teacher takes an active role in presenting the concept. Students make their own meaning out of the observations Four of four present 15 pts.	2. The teacher includes formal instruction using textbooks, audiovisuals, or demonstrations. Three of four are present. 13 pts.	3. Student's are encouraged to formulate solutions or answers in writing, through discussion, and/or in small group work? Two of four are present 10 pts.	4. The students' efforts are guided by the teacher; students are encouraging to reflect on their evidence, reasons, and the consequences or implications of their solutions? One of four are present 7pt.

	Science Content Background	You provided a thorough explanation of the science concept, and demonstrated a correct and thorough understanding of it in lesson and handout. 10 pts.	You provided a very short explanation of the science concept, and demonstrated some understanding of it in lesson and handout. 8 pts.	You provided an incomplete explanation of the science concept, and did not demonstrate a correct and thorough understanding of it in lesson and handout. 6 pts.	You provided a poor explanation of the science concept, and demonstrated a poor understanding of the science concept you were teaching in lesson and handout. 2 pt.
	Concept Application Phase	Does the Concept Application Phase have many tasks or problems where students apply the concepts to real-world, situations, or extend the concepts to new situations? Do students generate new questions, or articulate unresolved problems. 20 pts.	Does the Concept Application Phase have some tasks or problems where students apply the concepts to real-world, situations, or extend the concepts to new situations? Do students generate new questions, or articulate unresolved problems. 17 pts.	Does the Concept Application Phase have a few tasks or problems where students apply the concepts to real-world, situations, or extend the concepts to new situations? Do students generate new questions, or articulate unresolved problems. 15 pts.	The Concept Application Phase is missing tasks or problems where students apply the concepts to real-world, situations, or extend the concepts to new situations? Students do not generate new questions, or articulate unresolved problems. 0 pt.
	Handout	Handout included Learning Cycle Lesson Plan, and description of web sites related to concept. 10 pts.	Handout included lesson, but not website descriptions. 8pts.	Handout included website descriptions, but not lesson. 4 pts.	No Handout 0 pt.
	Presentation	Your presentation was outstanding. Evidence of planning and practice 10 pts.	Your presentation was well done. Some evidence of planning and practice 8 pts.	There was little evidence of planning and practice 4pts.	You did a presentation. 0 pts.