



SCHOOL OF EDUCATION

*Engaging diverse communities through leading and learning for social justice.*

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<b>Course Title</b>	Science Education In Elementary Schools
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<b>Course Location</b>	UH 443
<b>Semester / Year</b>	Fall 2015
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**SCHOOL OF EDUCATION MISSION & VISION STATEMENT**

*(Adopted by SOE Governance Community, January 2013)*

*Vision*

To serve the educational needs of local, regional, and global communities, the School of Education advances innovative practice and leadership by generating, embracing, and promoting equitable and creative solutions.

*Mission*

The mission of the School of Education community is to collaboratively transform education. We:

- Create community through partnerships
- Promote and foster social justice and educational equity
- Advance innovative, student-centered practices
- Inspire reflective teaching and learning
- Conduct purposeful research
- Serve the School, College, University, and Community

**BASIC TENETS OF OUR CONCEPTUAL FRAMEWORK**

- Student centered education
- Research and theory specific to the program field inform practice
- Connections and links between coursework and application
- Strong engagement between faculty and candidates
- Co-teaching clinical practice
- Culturally responsive pedagogy and socially just outcomes

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## COURSE DESCRIPTION

This course focuses on inquiry teaching to include: the Learning Cycle model, science process skills, science themes, scientific attitudes and habits of mind, and methods to involve all children in hands-on lessons. Emphasis is placed on instructional strategies, authentic assessments, exemplary science kits and curricula, as well as on the use of technology in science teaching. Methods of cross-cultural language and academic development are integrated into the course. Enrollment restricted to students in the ICP.

**Course Prerequisite:** Admission to the Multiple Subject Credential Program

### **Credit Hour Policy Statement**

For each hour of classroom time spent in learning in this course, each teacher candidate is expected to spend at least 2 hours of learning outside of the classroom. Examples of outside learning are text readings and reading responses, lesson planning, working on course assignments, and practice teaching with students.

## REQUIRED TEXT, MATERIALS, AND ACCOUNTS

### **Course Text:**

Friedl, A.E. & Koontz, T.Y. (2005). *Teaching Science to Children: An Inquiry Approach, 6<sup>th</sup> Ed.* NY: McGraw-Hill. ISBN: 0-07-256395-8

<b>Class Session/Date</b>	<b>Chapter No.</b>	<b>Weekly Schedule of Text Readings from <i>Teaching Science to Children: An Inquiry Approach</i></b>
8/31/2015	1 2 3	The Methods Teaching Science to All Children Technology in the Science Classroom
9/14/15		<i>Next Generation Science Standards</i>
9/21/15	4 5 6	The Characteristics of Matter Teaching Children About Heat Energy Teaching Children About Magnetism
9/28/15	7 8 9	Teaching Children About Static and Current Electricity Teaching Children About Sound Teaching Children About Light Lenses and Color
10/05/15	10 11 12	Teaching Children About Simple Machines Teaching Children About Air, Air Pressure and Flight Teaching Children About Weather and Climate
10/12/15	13 14 15	Teaching Children About Space Science Teaching Children About the Sun Moon and Stars Teaching Children About the Earth (Geology)
10/19/15	16 17 18	Teaching Children About the Oceans Teaching Children About Energy, Environment and Pollution Teaching Children About the Plant and Fungi Kingdom
10/26/15	19 20 21	Teaching Children About the Animal Kingdom Teaching Children About Nutrition and Health Teaching Children About Fitness: Heart, Lungs, and Muscles

## **Course Material Available**

### **Cougar Course Resources: \*\***

*A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas.* Available at: <http://www.nextgenscience.org/framework-k%E2%80%9312-science-education>  
*Next Generation Science Standards* (Achieve, 2013). Available at: [http://www.nextgenscience.org/Next Generation Science Standards for California Public Schools, K-12.](http://www.nextgenscience.org/Next-Generation-Science-Standards-for-California-Public-Schools-K-12) Available at: <http://www.cde.ca.gov/pd/ca/sc/ngsstandards.asp>

*Health Education Content Standards for California Public Schools K-12.* (2008). Sacramento: California Dept. of Education. Available at: <http://www.cde.ca.gov/be/st/ss/documents/healthstandmar08.pdf>

\*\* If the hyperlinks do not open a document, copy and paste the URL into a browser.  
*Other handouts (assignments guidelines and rubrics) and resources will be distributed in class and through the Moodle course site.*

## **COURSE LEARNING OUTCOMES:**

After successful completion of this course, students will 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 and use exemplary materials (technology and technology resources, curriculum, science programs, textbooks, equipment, ancillary materials) appropriate for K-8 school children.
3. Demonstrate knowledge, understanding, and use of the *Framework for K-12 Science Education* and the *Next Generation Science Standards*.
4. Demonstrate an understanding of the physical, earth, and life science concepts included in the *Next Generation Science Standards* by designing science lessons to teach the concepts.
5. Demonstrate an understanding of the Health Education Standards for California Public Schools and their connection/application to science content standards.
6. Plan, teach, and videotape a lesson focusing on a discrepant event in science.
7. Apply the Learning Cycle model of instruction as it relates to teaching science in a contemporary manner.
8. Identify and use simulation tools and demonstrate the use of technology to enhance elementary science teaching and learning.
9. Demonstrate confidence in leading and performing investigations designed to teach science concepts, science process skills, and scientific attitudes.
10. Effectively use authentic methods of assessment to evaluate learning of science concepts and processes.
11. Practice strategies to include all students in science (linguistically and culturally diverse, students with disabilities and other students with special needs).
12. Use reflection as a tool to increase conceptual understanding of science concepts and the ability to improve teaching.

## **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. Candidates successfully completing this program receive a credential with authorization to teach English learners. (Approved by CCTC in SB 2042 Program Standards, August 02)

## **Teacher Performance Expectation (TPE) Competencies**

The course objectives, assignments, and assessments have been aligned with the CTC standards for the Multiple Subject Credential. This course is designed to help teachers seeking a California teaching credential to develop the skills, knowledge, and attitudes necessary to assist schools and district in implementing effective programs for all students. The successful candidate will be able to merge theory and practice in order to realize a comprehensive and extensive educational program for all students. You will be required to formally address the following TPEs in this course:

### **TPE Primary Emphases in EDMS 545B:**

- TPE 1a-Subject Specific Pedagogical Skills for MS Teaching Assignments (Science)
- TPE 5-Student Engagement

### **TPE Secondary Emphases in EDMS 545B:**

- TPE 4-Making Content Accessible
- TPE 7-Teaching English Learners
- TPE 9-Instructional Planning
- TPE 14-Educational Technology in Teaching and Learning

## **Teacher Performance Assessment**

Beginning July 1, 2008 all California credential candidates must successfully complete a state-approved Teacher Performance Assessment (TPA), as part of the credential program of preparation. During the 2015-16 academic year the CSUSM credential programs will use either the CalTPA (California Teacher Performance Assessment) or the edTPA (Educative Teacher Performance Assessment).

Check with your program coordinator to determine which assessment is used for your credential program.

### **CalTPA**

To assist with your successful completion of the CalTPA, a series of informational seminars are offered over the course of the program. TPA related questions and logistical concerns are to be addressed during the seminars. Your attendance to TPA seminars will greatly contribute to your success on the assessment. The CalTPA Candidate Handbook, TPA seminar schedule, and other TPA support materials may be found on the SOE website:

<http://www.csusm.edu/education/CalTPA/ProgramMaterialsTPA.html>

### **edTPA**

Beginning in fall 2015, for newly entering initial candidates, the CSUSM assessment system is the edTPA. To assist with your successful completion of the edTPA, a capstone class is part of your curriculum. In this class edTPA related questions and logistical concerns are addressed. Additional support materials are available on the edTPA website:

[http://www.edtpa.com/PageView.aspx?f=GEN\\_Candidates.html](http://www.edtpa.com/PageView.aspx?f=GEN_Candidates.html)

Additionally, to support your success in your credential program and with TPA, SOE classes use common pedagogical language, lesson plans (lesson designs), and unit plans (unit designs).

## **Assessment of Professional Dispositions**

Assessing a candidate's dispositions within a professional preparation program is recognition that teaching and working with learners of all ages requires not only specific content knowledge and pedagogical skills, but positive attitudes about multiple dimensions of the profession. The School of Education has identified six dispositions – social justice and equity, collaboration, critical thinking, professional ethics, reflective teaching and learning, and life-long learning—and developed an assessment rubric. For each dispositional element, there are three levels of performance - *unacceptable*, *initial target*, and *advanced target*. The description and rubric for the three levels of performance offer measurable behaviors and examples.

The assessment is designed to provide candidates with ongoing feedback for their growth in professional dispositions and includes a self-assessment by the candidate. The dispositions and rubric are presented, explained and assessed in one or more designated courses in each program as well as in clinical practice. Based upon assessment feedback candidates will compose a reflection that becomes part of the candidate's Teaching Performance Expectation portfolio. Candidates are expected to meet the level of *initial target* during the program.

## GENERAL CONSIDERATIONS

### **School of Education Attendance Policy**

Due to the dynamic and interactive nature of courses in the School of Education, all candidates are expected to attend all classes and participate actively. At a minimum, candidates 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 candidate have extenuating circumstances, s/he should contact the instructor as soon as possible. (*Adopted by the COE Governance Community, December, 1997*).

For this class, **if you are absent 2 class sessions, your highest possible grade is a "B". If you are absent 3 class sessions, your highest possible grade is a "C+"**. Late arrivals and early departures will lower your course grade. For every two times that you are late and/or leave early, your course grade will be lowered by one letter grade. If you have an emergency, or very extenuating circumstances, please see the instructor to make arrangements accordingly. Absences do not change assignment due dates. If you find that you cannot attend class due to an emergency or very extenuating circumstances, please email any due assignments by the start of the class session it is due. NOTE: With few exceptions, late assignments will not be accepted.

### **CSUSM Academic Honesty Policy**

Students will be expected to adhere to standards of academic honesty and integrity, as outlined in the Student Academic Honesty Policy. All assignments must be original work, clear and error-free. All ideas/material that are borrowed from other sources must have appropriate references to the original sources. Any quoted material should give credit to the source and be punctuated accordingly.

Academic Honesty and Integrity: Students are responsible for honest completion and representation of their work. Your course catalog details the ethical standards and penalties for infractions. There will be zero tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty, in accordance with the general rules and regulations of the university. Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole.

Incidents of Academic Dishonesty will be reported to the Dean of Students. Sanctions at the University level may include suspension or expulsion from the University.

Refer to the full Academic Honesty Policy at:

[http://www.csusm.edu/policies/active/documents/Academic\\_Honesty\\_Policy.html](http://www.csusm.edu/policies/active/documents/Academic_Honesty_Policy.html)

### **Plagiarism**

As an educator, it is expected that each candidate will do his/her own work, and contribute equally to group projects and processes. Plagiarism or cheating is unacceptable under any circumstances. If you are in doubt about whether your work is paraphrased or plagiarized see the Plagiarism Prevention for Students website <http://library.csusm.edu/plagiarism/index.html>. If there are questions about academic honesty, please consult the University catalog.

## **Students with Disabilities Requiring Reasonable Accommodations**

Candidates with disabilities who require reasonable accommodations must be approved for services by providing appropriate and recent documentation to the Office of Disabled Student Services (DSS). This office is located in Craven Hall 4300, and can be contacted by phone at (760) 750-4905, or TTY (760) 750-4909. Candidates 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.

## **All University Writing Requirement**

In keeping with the All-University Writing Requirement, all courses must have a writing component of at least **2,500 words** (approximately 10 pages), which will be administered in a variety of ways in this course including lesson plans, assessment assignments, course text reading responses, reflections, concept maps; and journal writings on authentic teaching experiences.

## **Course Format**

Traditional face-to-face format

## **Use of Technology**

Candidates are expected to demonstrate competency in the use of various forms of technology (i.e. word processing, electronic mail, Moodle, use of the Internet, and/or multimedia presentations). Specific requirements for course assignments with regard to technology are at the discretion of the instructor. Keep a digital copy of all assignments for use in your teaching portfolio. Some assignments will be submitted online and some will be submitted in hard copy as well. All assignments will be submitted online, and some will be submitted in hard copy as well. Details will be given in class.

You must use your campus e-mail account for this class. The best way to contact me is by e-mail.

## **Electronic Communication Protocol:**

Electronic correspondence is a part of your professional interactions. If you need to contact the instructor, e-mail is often the easiest way to do so. It is my intention to respond to all received e-mails in a timely manner. Please be reminded that e-mail and on-line discussions are a very specific form of communication, with their own nuances and etiquette. For instance, electronic messages sent in all upper case (or lower case) letters, major typos, or slang, often communicate more than the sender originally intended. With that said, please be mindful of all e-mail and on-line discussion messages you send to your colleagues, to faculty members in the School of Education, or to persons within the greater educational community. All electronic messages should be crafted with professionalism and care.

Things to consider:

- Would I say in person what this electronic message specifically says?
- How could this message be misconstrued?
- Does this message represent my highest self?
- Am I sending this electronic message to avoid a face-to-face conversation?

In addition, if there is ever a concern with an electronic message sent to you, please talk with the author in person in order to correct any confusion.

## **Computer Use During Class Sessions**

You are welcome to use a laptop computer in class (in fact, it is highly encouraged to bring your laptop to class for various activities and for researching) when working on class assignments, for example. However, you will need to save checking email or other personal computer use for time outside of class. Most students find it disruptive when they are focusing on class activities or listening to presentations and can hear keyboarding in the classroom. Please be considerate of your instructor and peers in this regard. It is greatly appreciated by all!

### **Cell Phones**

Please turn off your cell phone before the start of each class. In addition, there will be no texting during class. It is unprofessional for teachers to use their cell phone during meetings with peers or during professional development activities (our class is considered professional development!). Your consideration will be appreciated by peers.

### **Person-First Language**

Use “person-first” language in all written and oral assignments and discussions (e.g., “student with autism” rather than “autistic student”). Disabilities are not persons and they do not define persons, so do not replace person-nouns with disability-nouns. Further, emphasize the person, not the disability, by putting the person-noun first.

## **COURSE TOPICS OUTLINE**

- The Nature of Science
- Discrepant Events in Science Teaching
- The Learning Cycle Model of Teaching
- Learning Cycle Science Lesson Demonstrations
- Writing Objectives for Student Learning
- Developing Essential Questions for Teaching Science
- Writing Science Concept Definitions
- California Science Framework
- *The Next Generation Science Standards*
- SDAIE Strategies in Science: Teaching Science to English Learners
- Inclusion and Teaching Science to Students with Special Needs
- Differentiating Instruction and Assessment in Science
- Authentic Assessments in Science
- Infusing Writing Activities in Science Lessons
- Science Curriculum Kits and State Approved Texts
- Science Process Skills and Scientific Attitudes
- Current Issues in Science Education
- Infusing Technology Tools into Science Planning and Teaching
- Science Projects, Student Research, Science Fairs
- Safety in the Science Class
- Concept Mapping

## COURSE REQUIREMENTS AND GRADED COURSE COMPONENTS

### Assignments Tied To Course Learning Outcomes

The following assignments contribute to the final, overall course grade. A weighted percentage (percentage scale) is given for each assignment. Each written assignment is expected to have a clear organizational presentation and be free of grammar, punctuation and spelling errors. There will be a reduction in points for the above mentioned errors. Late assignments are not accepted. Prepare carefully for class, and be ready to discuss readings and assignments thoughtfully. Note Grading Standards and the Description of Exemplary Students on page 18 of this syllabus.

	<b>Possible Points</b>	<b>% of Total Course Grade</b>
1. Active Participation and Collaboration (all or nothing credit given)	5 pts.	5%
2. Book Club: Reading Responses and Concept Maps - (Individual)	60 pts.	15%
3. Next Generation Science and Health Standards Tasks and Presentation – (Indiv. & Grp).	50 pts.	10%
4. Discrepant Event Lesson Plan, Presentation, & Videotape – (in pairs)	150 pts.	25%
5. Discrepant Event Reflection Paper - Individual	5 pts.	5%
6. Invention Convention – (In pairs)	150 pts.	20%
7. Capstone Related Hands-On Lesson Sketch (ID 381 Capstone group)	10 pts.	10%
8. Integration of Technology Plan (In pairs )	50 pts.	10%

**NOTE:** *Each student is responsible for ensuring that assignments are submitted correctly and on time. Most assignments will be submitted in hard copy at the start of class (per course schedule), and some specific assignments will also be submitted electronically to Moodle as class resources. Keep a digital copy of all assignments for your credential program electronic portfolio.*

### Final Exam Statement

There is no final exam in this course.

### Grading Standards

Total percentage of the course for each assignment is indicated in the list of assignments and in the assignment descriptions. A complete description of final grading standards is located on p. 14 of this syllabus

### Policy on Late/Missed Work

Due to the interactive nature of the course and assignments that require timely preparation and planning, with very few exceptions, late assignments will not be accepted. Please contact the course instructor if there are extenuating circumstances that impede the completion of a course assignment by the DUE date.

### Student Collaboration Policy

Candidates will be required to work collaboratively on selected assignments and projects with classroom peers. The expectation for such collaborations is that each candidate will contribute equitably to the process and final product.

## DESCRIPTIONS OF ASSIGNMENTS

### 1. Active Participation and Collaboration - 5% (all or nothing credit)

Teacher education is a professional preparation program and students will be expected to adhere to standards of dependability, professionalism, and academic honesty (refer to rubric attached to this syllabus). Grading will include a component of "professional demeanor." Students will conduct themselves in ways that are generally expected of those who are entering the education profession, including the following:

- On-time arrival to all class sessions and attendance for the entire class period
- Advance preparation of readings and timely submission of assignments
- A **POSITIVE** attitude at **ALL** times
- Active participation in all class discussions and activities
- Respectful interactions and courteous language with the instructor and other students in all settings
- Carefully considered, culturally aware approaches to solution-finding

**Class Discussions and Participation:** Students will engage in active learning each class session, and will be expected to actively participate. You may lose points for lack of participation based on the following criteria:

- Do you participate in class discussions productively, sharing your knowledge and understandings?
- Do you interact productively with your peers, taking on a variety of roles (leader, follower, etc.)?
- Do you contribute appropriately to group work—do you "do your share"?
- Are you able to accept others' opinions?
- Are you supportive of others' ideas?
- Do you support your peers during their presentations?
- Can you monitor and adjust your participation to allow for others' ideas as well as your own to be heard?

### 2. Book Club: Reading Responses and Concept Maps – 15% (Individual)

You will be pre-assigned to a Book Club group in the first class session. Each week your pre-assigned group will decide which group member will read which of 3 text chapters: Each group member will:

- Choose one chapter each week from the assigned readings and provide evidence of having read and understood the major content of the chosen chapter. You may choose to demonstrate your knowledge of ALL of the Big Ideas contained in the readings by preparing a graphic organizer, a concept map, a bulleted list, drawings, or another method of your choice. The complete list of choices is located in Moodle. Please ensure that all of the main ideas are included in your reading response, regardless of your choice of format. *Of the six total Reading Responses, THREE concept maps are required (your choice of which 3 chapters).*

**Note:** Do not include chapter science activities in your reading responses and concept maps. Although very essential, these application activities bring the concepts to life and are intended to promote your understanding of science concepts.

- Engage in classroom activities that are designed for you to demonstrate your understanding of the text and other readings. You and your group members will each teach each other your chapter concepts during the **Book Club** sessions at the beginning of each class session. Please ensure that you are *well prepared* to teach your peers—they'll be depending on you! Please provide each of your group members with a hard copy of your chapter reading format.

### 3. Next Generation Science Standards (NGSS) and Health Education Standards Activity - 10%

Purpose of the assignment: To provide an in-depth introduction to the NGSS as a framework and foundation for you to begin to create science curriculum in other course assignments.

**Task I A: Grade level Next Generation Science Standards Response: (Individual) – 25 pts.**

Using the NGSS for your chosen grade level, pick ONE Performance Expectation (PE) from EACH standard. For each PE, come up with a brief description of an activity that children in that grade can do. You should end up with a standard, a PE, and a 3-4 sentence description of an activity.

See examples on page 9 for what your sections should look like. Depending on the grade level, you might have fewer or more sections.

**NOTE:** *These must be HANDS-ON science activities, not Internet research or writing activities!!!*

**Task I B: Grade level Health Education Content Standards Response (Individual) – 5 pts.**

The Health Education Content Standards for California Public Schools are categorized into 8 Health Content Standards: Essential Health Concepts; Analyzing Health Influences; Assessing Valid Health Info; Interpersonal Communication; Decision Making; Goal Setting; Practicing Health Enhancing Behaviors; and Health Promotion. These 8 content standards are included in 6 Health Content Areas: Nutrition and Physical Activity; Growth, Development & Sexual Health; Injury Prevention and Safety; Alcohol, Tobacco, and Other Drugs; Mental, Emotional, and Social Health; and Personal and Community Health.

For the same grade level assigned to you for Task I A, you will select one Health Content Standard under one of the Health Content Areas and write an activity that students in that grade level can do.

You should end up with one section for Health Education, which includes one Health Content area, one Health Content Standard, and a 3-4 sentence description of an activity that reflects both.

**Hard Copy due date: Class session 2. Upload your Task I A AND Task I B (as ONE document) to Moodle session 2.**

The complete write up for Tasks I A and I B should be no more than two pages. See page 9.

**Task II: Team lesson sketch (10 pts.), preparation, and presentation (10 pts.) – (in class with your team) – 20 pts. total**

Get together with your team. Look at the activities that were collectively written up for Task I A. Choose one activity. Then...

- As a team, word process a lesson sketch/description for the activity (with a lesson title, NGSS standard and Performance Expectation, learning objectives, an assessment plan, and a detailed description of the activity). Make sure you write out the standard and PE on which your lesson plan is based. Add the **group lesson sketch** to the group PPT below.
- As a team, come up with a brief overview of the NGSS Standards for your grade. Don't try to give us every single line of the standards. Summarize in such a way (use bullet points) that we see generally what students are supposed to learn in your grade level--the Big ideas. On a PPT, list the bulleted competencies indicated in the NGSS for your grade. Upload your group PPT to Moodle session 2.
- Each team member should also add to the group PPT his/her Health Content Standard/Health Content Area idea (i.e., Task I B)
- In about 12 minutes, present your lesson plan sketch and science standards overview to the class. Be prepared to explain why your lesson activity represents really good science for kids.

Your grade for this assignment will be based on the content and quality of your presentation, and on the level of collaboration with your team.

**Hard Copy of Lesson Sketch due date: Class session 2:** Upload the group lesson sketch done for Task II and the group PPT to Moodle session 2. **Note: One group member, place the group lesson sketch in your course folder with all team members' names on the lesson sketch.**

**Sample Response to Assignment Tasks I A and I B.**

## Grade Four: Next Generation Science Standards

Standard 4-PS3: Physical Science - Energy

Performance Expectation 4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Activity:

Using one flashlight bulb, one insulated copper wire, and one D-battery, students will determine how to create a complete electrical circuit in order to light the bulb. Students will then use 3 insulated copper wires, one flashlight battery, a battery holder, one D-cell battery, and a brass brad inserted into a 3x5 note card to create a switch that turns the light bulb on and off.

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Standard 4-PS4: Physical Science – Waves and Their Applications in Technologies for Information Transfer

Performance Expectation 4-PS4-2: Develop a model to describe that light reflecting from objects and entering the eyes allows objects to be seen.

Activity

Using a prism and a flashlight, each student will separate the component colors of white light through refraction by shining the flashlight through the prism onto a white surface (e.g., a white wall, a whiteboard) in the classroom. Using color paddles and a flashlight, student triads will explore how to produce white light.

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Standard 4-LS1: From Molecules to Organisms: Structures and Processes

Performance Expectation 4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Activity

Using a fresh, white carnation flower placed overnight in a vase containing food coloring and water, students will use a scalpel to dissect the stem to reveal that the colored water was transported through the xylem to the flower through capillary action occurring from the roots to stem to flower.

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Standard 4-ESS1: Earth's Place in the Universe

Performance Expectation 4-ESS1-1: Identify evidence from patterns in rock formations and fossils in rock layer to support an explanation for changes in a landscape over time.

Activity: How Do Geologists Study the Earth's Interior? The teacher will prepare 3 different colors of cake batter and layer the 3 colored batters (vary layers in each cupcake) in foil baking muffin cups. Drop in small pieces of seashells and dried plant leaves into one specific layer (vary each cupcake). Top each cupcake with frosting (after baking) to model soil. Each student will use a transparent plastic straw, a toothpick, and a piece of paper folded into 4 sections. One section is a prediction of what the inside of the cupcake might be. The remaining 3 sections are drawings of core samples using the straw cut to appropriate lengths.

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Standard 4-ESS2: Earth's Systems

Performance Expectation 4-ESS2-2: Analyze and interpret data from maps to describe patterns of Earth's features.

Activity: Using a foam mountain kit, students will construct a mountain and identify the base, peak, and elevation. Using each piece, students will first construct a topographic map and identify contour lines, the contour interval, and slope steepness. Students will then construct a mountain profile using the data generated from the topographic map.

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Standard 4-ESS3: Earth and Human Activity

Performance Expectation 4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Activity: Using 30 toothpicks and 30 mini-marshmallows, each student will construct an earthquake resistant structure using cubes and triangles that will be tested in a rectangular pie pan with solidified Jello®. Students may cut toothpicks in half to build their structure. The teacher will shake each pie pan using horizontal motions (gentle pressure, mid-pressure, violent pressure) to simulate horizontal movement of an earthquake.

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Health Content Area: Nutrition and Physical Activity

Health Content Standard 1.8.N - Identify ways to increase and monitor physical activity.

### Activity

In pairs, students will take turns in a jump rope activity. Starting with 5 jumps and increasing the jumps by 5, they will observe and record the maximum number of jumps that their partner can comfortably complete.

#### **4. Discrepant Event Lesson Elements and Description – 25%**

An attention getting, thought-provoking approach to initiate inquiry in science is through the use of **Discrepant Events (DE)**. Discrepant Events are phenomena that seem to run contrary to what we normally expect. The outcomes or results are very different from what we might think would happen or should be happening. A discrepant event puzzles the observer and leaves him/her at a loss to explain what has taken place, causing him or her to wonder why the event occurs as it did. Situations that are contrary to what a person expects cause him or her to wonder what is taking place, resulting in cognitive disequilibrium. Like a hard-boiled egg that can squeeze inside a narrow neck bottle, or observing water flowing upwards, these occurrences tend to move students from a state of cognitive equilibrium to a state of cognitive dissonance or disequilibrium.

In this assignment, you and a partner will plan, implement, and videotape a discrepant event to first practice with and videotape a student or small group of students of your choice and then present the activity to your cohort peers. **The complete and detailed guidelines for this assignment are located in the course Moodle. The DE Graphic Organizer template and the Discrepant Event Presentation and Lesson Rubric are located on the Moodle course.**

For your discrepant event, fill in the graphic organizer with the appropriate information in strong detail. One team member: Please upload the team's DE to the Moodle session corresponding to the date that you present your DE in our class.

*On the day of your DE presentation, please begin the lesson by turning in 1 hard copy of your completed Discrepant Event Lesson Template/Organizer and data sheets (if applicable) to me. NOTE: Please provide in stapled form—unstapled lessons will not be accepted.*

#### **Provide the following information at the end of your DE document after the template:**

- a. Science Content Background: 1 page (1.5 line spacing) summary of the **science content background** that **teachers** need to know to effectively teach the lesson (goes beyond lesson content knowledge a teacher needs to know).
- b. **References**: Title, author, publisher, year of all resources consulted for lesson plan concepts ideas, and/or activities.

#### **5. Discrepant Event Reflection Paper –Based on working with Children (Individual) - 5%**

- After you have done your discrepant event with a student or students AND videotaped the event, look at your notes and think about how it went. You may realize that your event needs to be modified before you do it with our class.
- Write a description of what happened, with special attention to what the child/children said and did. Analyze the child's/children's response: what portions of the event, and to what extent, did the child/children understand what was happening? Why or why not?
- *Be very specific and clear about what the child(ren) did, said, and how he/she/they responded to the DE activity. The reflection should be thorough, thoughtfully written, and detailed to receive full credit.*
- *Note: Do NOT turn in a DE Reflection if you did not videotape the DE teaching event. The video substantiates that you did, in fact, teach your team DE to a student or students. Please consider that this assignment is 10% of your course grade.*
- Due no later than session 13 of the course—no exception!

## 6. Invention Convention – 20%

Invention is a creative outgrowth of process science. Fostering the development of important science skills is an ongoing challenge. Students should be given opportunities to solve problems, think, creatively, experiment, and work with data throughout the school year. The Invention Convention is an event that gives students an opportunity to demonstrate these skills independently as they invent a new product or process. The Invention Convention can be a classroom, school, or district-wide science event. This science event is designed to encourage students to apply basic science skills in a creative, productive manner. Participants are encouraged to identify a need or to solve a problem by following the same steps and procedures that an inventor would follow in patenting an invention. Once a need or a problem has been identified, students are directed to use problem-solving and creative-thinking skills to invent a product or process that would fill the need or overcome the problem. Communication and research skills are also greatly enhanced throughout the invention procedure.

In this assignment, you and a group of peers will collaboratively engage in the invention process to learn how to guide your own students' inventive skills. **Please access the complete assignment guidelines on the Moodle course site.**

## 7. Capstone Related Hands-On Lesson Sketch (in Capstone Group) - 10%

Purpose: To develop a science activity lesson appropriate for elementary students and which is connected to your ICP Capstone project for ID 381 (*Natural Science for Teachers*). The lesson should be an elementary level lesson that highlights the science topic on which your project is based (e.g., mechanical waves, gravity, thermodynamics, etc.). Your ID 381 project is a college-level investigation, but the lesson/lesson activity should focus on *one* elementary or middle school grade level from K-8. Be sure you understand the concept you are emphasizing, and that you can explain it to young learners. The activity should be developmentally appropriate, student-centered, must include hands-on tasks, and should emphasize the particular science concept highlighted in your capstone. You will present the lesson and engage your peers in the capstone presentation (TBA by your ID 381 instructors)

The following is an abbreviated lesson plan template with the **Essential Elements** that must be included.

1. **Lesson title** – Create a “catchy” title that will attract and motivate students to engage in your activities.
2. **Grade level:** For what grade level is your lesson developmentally appropriate?
3. **Content Area & Subject Matter** (e.g., *Electrical circuits, Physical Science*)
4. **Next Generation Science Standards and Performance Expectations** addressed in the lesson
5. **Science Concept(s)** you are teaching. Write it out in a complete sentence(s). Do not say, “The students will \_\_\_\_.” (That is an objective, not a science concept.)

*Example of science concept: Electricity is a form of energy generated by the flow of electrons through a conducting substance.*

6. **Time for Lesson:** How long will your lesson take from beginning to end?
7. **Essential Questions (EQs):** Ensure high order questions!  
List at least two essential questions specific to the concept that you want students to be able answer during the lesson. What is it that students should be able to answer by having successfully participated in your lesson? These are based on the BIG Ideas (tied to the learning objectives) of your lesson to focus student learning and should be high order questions (see [Bloom's Taxonomy](#)). EQs do not have to be in interrogatory form:

*Example: Describe the difference between a closed circuit and a closed circuit.*

*Example: Explain the difference between series and parallel wiring of batteries and bulbs*

8. **Learning objective(s) based on the content standards:** What do you want students to be able to do? Write in complete sentences. Use an action verb and explain how students will demonstrate their new knowledge and understanding.

Examples:

“After successful completion of the lesson, the student will demonstrate understanding of \_\_\_\_\_ by \_\_\_\_\_.”

Or, “After successful completion of the lesson, the student will be able to \_\_\_\_\_”

*Example of learning objective: “Using two dry cells, four short pieces of insulated copper wire, and one 3-volt flashlight bulb, students will be able to accurately demonstrate series wiring and parallel wiring to light one bulb after successful completion of the lesson.”*

*Example of learning objective: “After successful completion of the lesson, the student will be able to accurately demonstrate series wiring and parallel wiring to light two light bulbs by using two dry cells, four short pieces of insulated copper wire, and two 3-volt flashlight bulbs.”*

9. **Materials and Resources** (what the teacher needs; what the students need including technology if applicable)
10. **Detailed description of the lesson activity.** Describe what the teacher does and what the students will do.
11. **Assessment Plan:** Description of the assessment plan to determine if your students have met the learning objectives of your lesson.
12. **References** used for the lesson. State references in APA 6<sup>th</sup> Ed: Author last name, author first initial. (year). *Title of book.* City, State: Publishing company

### 8. Integration of Technology Plan - w/DE group members) (10%)

You and your group members will plan a technology lesson to support the topic chosen for your Discrepant Event. More details will be given in class, and the assignment guidelines are located on Moodle.

## RESOURCES THAT CAN HELP IN YOUR LEARNING OF SCIENCE CONTENT AND METHODS

### 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
School Science and Mathematics		

### Other Recommended Resources

Great Explorations in Math & Science (G.E.M.S.) Lawrence Hall of Science. <http://www.lhs.berkeley.edu/GEMS/>

Activities Integrating Math and Science. Aims Education Foundation.  
<http://www.aimsedu.org/>

### Final Grade Standards

A = 93-100	B = 83-86	C = 73-76	F = 0-59
A- = 90-92	B- = 80-82	C- = 70-72	
B+ = 87-89	C+ = 77-79	D = 60-69	

It is expected that students will proofread and edit all their assignments prior to submission. Students will ensure that the text is error-free (grammar, spelling), and ideas are logically and concisely presented. The assignment's grade will be negatively affected as a result of this oversight. Each assignment will be graded approximately 80% on content and context (detail, logic, synthesis of information, depth of analysis, etc.), and 20% on mechanics. All reference/resource citations should use appropriate citation form. Please consult with the American Psychological Association (APA) format in the APA Manual, 5<sup>th</sup> edition for citation guidance.

**NOTE:** You must maintain a B average (3.0 GPA) in your teacher education courses to receive a teaching credential from the State of California. Courses are not accepted if final course grades are below a C+.

### **Exemplary “A” Students**

1. Demonstrate serious commitment to their learning, making full use of the learning opportunities available and searching out the implications of their learning for future use.
2. Complete all assignments thoroughly, thoughtfully and timely.
3. Make insightful connections between assignments and their developing overall understanding of science concepts; continually questioning and examining assumptions in a genuine spirit of inquiry.
4. Attends every class, always timely, and shows high level achievement of course goals.
5. Display a “can do” attitude, give 100%, and works to help others learn too.
6. Contributes a great deal to class environment, showing respect and concern for all members.

### **“B” Students**

1. Completes all assignments, all on time, and demonstrates the ability to summarize, analyze, and/or reflect at fairly high levels, showing consistent improvement over time.
2. Completes all of the reading assignments and develops thoughtful and fairly thorough responses.
3. 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.
4. Develops presentations demonstrating significant learning.
5. Presents confidently and intelligently, demonstrating effective teaching skills.
6. Attends every class meeting and is regularly engaged during class.
7. Contributes to the positive environment of the class by respecting all members.

*It is expected that students will proofread and edit all their assignments prior to submission. Students will ensure that the text is error-free (grammar, spelling), and ideas are logically and concisely presented. The assignment's grade will be negatively affected as a result of this oversight. Each assignment will be graded approximately 80% on content and context (detail, logic, synthesis of information, depth of analysis, etc.), and 20% on mechanics. All reference/resource citations should use appropriate citation form. Please consult with the American Psychological Association (APA) format in the APA Manual, 6<sup>th</sup> edition for citation guidance.*

## COURSE SCHEDULE

Class Session	Date	Topics & Activities	Text Readings & Work Due
1	8/31/15	<p><b>Course Overview/Syllabus Review</b></p> <p><b>Next Generation Science Standards (NGSS)</b> ~ NGSS Standards Tasks IA, IB, II explained</p> <p><b>Groups Sign-ups:</b> ~ NGSS Standards ~ Book Club ~ Invention Convention</p> <p>~ <b>Discrepant Events in Science groups sign-ups</b></p> <p>~ <b>The Nature of Science</b> ~ A Private Universe (tentative)</p>	<p><b>Bring course syllabus to class</b></p> <p><b>Bring course text to class</b> - Read Chapters 1 and 2, 3 of <i>Teaching Science to Children</i> as a framework and foundation for course concepts &amp; skills</p> <p>Access and read <b>NOS document:</b> <a href="http://www.nextgenscience.org/sites/ngss/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf">http://www.nextgenscience.org/sites/ngss/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf</a></p> <p><b><a href="http://www.indiana.edu/~ensiweb/nos.pdf">http://www.indiana.edu/~ensiweb/nos.pdf</a></b></p>
2	9/14/15	<p><b>Next Generation Science Standards Presentations</b></p> <p><b>Intro to Concept Mapping of science content: The Big ideas in Science Teaching &amp; Learning</b></p> <p>Science inquiry activities</p> <p><b>Sequencing Instruction to Support Learning Outcomes:</b> What teaching strategies ensure participation of ALL students?</p>	<p>Bring Next Generation Science Standards book to all classes.</p> <p><b>Due: NGSS Tasks IA &amp; IB (Individual). Post to Moodle AND hard copy in course folder</b></p> <p><b>DUE: NGSS Task II presentations due (team): Post group Lesson Sketch and group PPT to Moodle – (one group member posts for team AND one person places group lesson sketch in his/her folder with team members' names)</b></p>
3	9/21/15	<p><b>Book Club Session</b></p> <p><b>Lesson Planning in Science Inquiry - Discrepant Events:</b> Why teach science this way?</p> <p><b>Sequencing Instruction to Support Learning Outcomes:</b> <b>II. The Learning Cycle:</b> Using the 5-E model Writing <b>Essential Questions</b> Writing <b>Learning Objectives</b> to support assessment in science</p> <p>~ Science inquiry activities</p>	<p>Read Learning Cycle Handout on Moodle and bring a copy to class or download to computer</p> <p><b>***Access Discrepant Events Assignment Guidelines on Moodle course site</b></p> <p>Read Chapter 4 or 5 or 6 of <i>Teaching Science to Children</i></p> <p><b>Due: Book Club Reading Response (4, 5, 6) or Concept Map 4, 5, or 6</b></p> <p><b>Discrepant Events Topic chosen and finalized by Session 3 (9/21//15). Please vet your activity with the course instructor.</b></p> <p><b>***DE presentations begin in Session 5.</b></p>

Class Session	Date	Topics & Activities	Text Readings & Work Due
4	9/28/15	<p><b>Book Club Session</b></p> <p><b>Investigative Science Learning: “Doing” Science in the Classroom</b>  ~The Scientific Method  ~ Research Questions and Hypotheses  ~ Carrying out a research plan</p> <p>Making Science Content Accessible to ALL students:  ~ Adapting science curriculum for <b>students with special needs</b></p> <p>Science inquiry activities</p> <p><b>Check in on Discrepant Events Lessons for in-class presentations starting next week.</b></p> <p><b>Intro to Citizen Science: Bring your computer!</b></p>	<p><i>Read Chapter 7 or 8 or 9 of Teaching Science to Children</i></p> <p><b>Due: Book Club Reading Response (7, 8, 9) or Concept Map: 7, 8, or 9:</b></p> <p><a href="http://www.glencoe.com/sec/teachingtoday/subject/special_ed.phtml">http://www.glencoe.com/sec/teachingtoday/subject/special_ed.phtml</a></p> <p><a href="http://www.teachingtips.com/blog/2008/06/25/the-ultimate-guide-to-special-needs-teaching-100-resources-and-links/">http://www.teachingtips.com/blog/2008/06/25/the-ultimate-guide-to-special-needs-teaching-100-resources-and-links/</a></p> <p><a href="https://www.asdk12.org/depts/science/ESCARGOweb/documents/ScienceInquiry.pdf">https://www.asdk12.org/depts/science/ESCARGOweb/documents/ScienceInquiry.pdf</a></p>
5	10/05/15	<p><b>Book Club Session</b></p> <p><b>Inquiry Processes in Science:</b>  Science process skills &amp; scientific attitudes</p> <p>Science safety guidelines for the science classroom</p> <p>Science inquiry activities</p> <p><b>Introduction to Invention Convention: Group brainstorm list-upload to Moodle Session 6.</b></p>	<p><i>Read Chapter 10 or 11 or 12 of Teaching Science to Children</i></p> <p><b>Due: Book Club Reading Response (10, 11, 12) or Concept Map: 10, 11, or 12</b></p> <p><b>***Discrepant Events Presentations: Teams 1 &amp; 2. Post DE Lesson Template to Moodle—one posting per team.</b></p> <p><b>Provide a link to video. Upload DE Reflection to Moodle.</b></p>
6	10/12/15	<p><b>Book Club Session</b></p> <p><b>Teaching Science to English Learners</b></p> <p><b>Assessment:</b> What are the best indicators to assess that students have learned and understood the intended outcomes?</p> <p>Science inquiry activity</p>	<p><a href="http://www.csun.edu/science/ref/language/teaching-ell.html">http://www.csun.edu/science/ref/language/teaching-ell.html</a></p> <p><i>Read Chapter 13, 14, or 15 of Teaching Science to Children</i></p> <p><b>Due: Book Club Reading Response (13, 14, 15) or Concept Map: Ch. 13, 14, or 15</b></p> <p><b>*** Discrepant Events Presentations: Teams 3 &amp; 4. Post DE Lesson Template to Moodle—one posting per team.</b></p> <p><b>Provide a link to video. Upload DE Reflection to Moodle</b></p>

Class Session	Date	Topics & Activities	Text Readings & Work Due
7	10/19/15	<p><b>Book Club Session</b></p> <p>Writing Across the Curriculum</p> <p><a href="http://www.michigan.gov/documents/mde/Science_WAC_2_3_264454_7.pdf">http://www.michigan.gov/documents/mde/Science_WAC_2_3_264454_7.pdf</a></p> <p>Science inquiry activity</p>	<p><i>Read Chapter 16 or 17 or 18 of Teaching Science to Children</i></p> <p><b>Due: Book Club Reading Response (16, 17, 18) or Concept Map: 16, 17, or 18</b></p> <p><b>*** Discrepant Events Presentations: Teams 5, 6, &amp; 7. Post DE Lesson Template to Moodle—one posting per team.</b></p> <p><b>Provide a link to video. Upload DE Reflection to Moodle</b></p>
8	10/26/15	<p><b>Book Club Session</b></p> <p>Science Exploratoriums</p> <p><a href="http://www.exploratorium.edu/">http://www.exploratorium.edu/</a></p> <p><a href="http://www.nonprofitcommons.org/content/npc-52413-featured-presentation-exploratoriums-virtual-museum-and-immersive-science">http://www.nonprofitcommons.org/content/npc-52413-featured-presentation-exploratoriums-virtual-museum-and-immersive-science</a></p> <p><b>Invention Convention: Check in on progress of IC groups</b></p> <p><b>Field Trip (TBD) or Guest Speaker</b></p>	<p><i>Read Chapter 19, 20, or 21 of Teaching Science to Children</i></p> <p><b>Due: Book Club Reading Response (19, 20, 21) or Concept Map: 19, 20, or 21</b></p> <p>Start finalizing Discrepant Events Lab Books</p>
9	11/02/15	<p>Start planning for ID 381 capstone related science lesson plan with capstone group</p> <p><b>Introduction to Coding Skills for Kids: Kodable and Scratch apps: Bring your iPad!</b></p>	<p><b>Continue work on ID 381 capstone related science lesson</b></p> <p><b>DUE: DE Lab Notebooks</b></p>
10	11/09/15	<p><b>Technology In Science Teaching and Learning: Science Web resources &amp; tools to enhance science teaching and learning</b></p> <p><a href="http://astroventure.arc.nasa.gov/">http://astroventure.arc.nasa.gov/</a></p> <p><a href="http://www.chem4kids.com/files/atom_intro.html">http://www.chem4kids.com/files/atom_intro.html</a></p> <p><a href="http://www.sciencechannel.com/games-and-interactives/charles-darwin-game.htm">http://www.sciencechannel.com/games-and-interactives/charles-darwin-game.htm</a></p> <p><a href="http://www.sciencenewsforkids.org/">http://www.sciencenewsforkids.org/</a></p> <p><a href="http://wonderopolis.org/">http://wonderopolis.org/</a></p> <p><a href="http://thinkquest.org/pls/html/f?p=52300:30:1872490608647644:::P30_CATEGORY_ID:CPJ_SCIENCE_TECHNOLOGY">http://thinkquest.org/pls/html/f?p=52300:30:1872490608647644:::P30_CATEGORY_ID:CPJ_SCIENCE_TECHNOLOGY</a></p> <p><a href="http://www.lhsgems.org/gemsguides.html">http://www.lhsgems.org/gemsguides.html</a></p>	

<b>Class Session</b>	<b>Date</b>	<b>Topics &amp; Activities</b>	<b>Text Readings &amp; Work Due</b>
11	11/16/15	Informal Science Institutions (ISIs) Virtual Science Field Trips  <b>Begin finalizing Invention Convention assignment components including oral presentations in Session 13.</b>	<a href="http://caise.insci.org/">http://caise.insci.org/</a> <a href="http://www.crystalcovestatepark.com/">http://www.crystalcovestatepark.com/</a> <a href="http://www.westerncentermuseum.org/">http://www.westerncentermuseum.org/</a> <b>Begin Finalizing IC Final report, model/prototype/blueprint/mockup, and commercial. Refer to assignment guidelines for specific details.</b>
12	11/23/15	<b>Field Trip (TBD) or Guest Speaker</b>	
13	11/30/15	<b>Final Invention Convention Oral Presentations</b>	<b>Please ensure that your team 1. Final Invention Convention Final Report, 2. Invention Model Sketch, and 3. Marketing tool are posted to the appropriate link in Moodle Session 8.</b>  <b>DUE: Capstone-related lesson plan assignment. One group member: Upload to Moodle</b>  <b>DUE: Integration of Technology One group member: Upload to Moodle</b>
14	12/07/15	<b>Last day of class Course Wrap-Up</b>	<b>End of course reflections</b>

**NOTE: While this syllabus is carefully planned, it may be modified or adjusted at any time in response to the learning needs of the class.**