

## **EDSS 545 a and b Secondary Science Methods (3.0 Credits ) 2003-4**

**Instructor:** Joseph Keating, Ph.D.

**Office:** UH 309 **Phone:** 760-7504321

**E-mail:** [jkeating@mailhost1.csusm.edu](mailto:jkeating@mailhost1.csusm.edu) **Fax:** 760-7503237

**Description/ Goals:** This course will be held both first and second semester for a total of 3 credits (approximately 22 contact hours per semester). Upon completion of this course, the preservice teacher will be able to formulate a basis to teach science in the secondary school in a manner that is exciting, creative and rigorous. To accomplish this, the candidate will formulate a personal framework based on both a historical/philosophical perspective as well as the knowledge of state and national reform documents. Using this framework, he (she) will be able to apply multiple strategies and resources in the development of unit plans, instructional delivery and assessment that utilize a student centered, problem-solving approach to the teaching of science.

**Major Themes/Objectives: (the student will have a broad perspective and practice in using.....)**

- 1)major frameworks, programs and standards for Science Education in California and the United States
- 2)the history and philosophy of science
- 3) resources, materials available for science education including texts, lab manuals, technology and community related resources
- 4) methods of safe and effective science teaching methodologies that include experience in inquiry based learning, the use of the laboratory, community based or field work, research, enrichment activities and assessment.
- 5) detailed planning of curricula in science as well as in the incorporation of science into the design of interdisciplinary units.
- 6) SDAIE methods that enhance the science curriculum for culturally and linguistically diverse students.
- 7) a cognitively sound inquiry based application of science content

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

This course is designed to help teachers seeking the Multiple Subjects Credential to develop the skills, knowledge, and attitudes necessary to assist schools and district in implementing an effective program 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. The following TPE's are addressed in this course:

#### **Primary Emphasis**

- TPE 1B Subject specific pedagogical skills
- TPE 3 Interpretation and Use of Assessments
- TPE 4 Making content assessable
- TPE 6C Developmentally Appropriate for 9-12
- TPE 6D Developmentally Appropriate for special education
- TPE 9 Instructional Planning
- TPE 10 Instructional Time

Secondary Emphasis:

TPE 2 Monitoring student learning during instruction  
TPE 5 Student Engagement  
TPE 7 Teaching Second Language Learners  
TPE 11 Social Environment  
TPE 12 Professional, Legal and Ethical Obligations  
TPE 13 Professional Growth

**Required Texts:**

Science Instruction in the Middle and High School (Chiappetta and Koballa)  
California Frameworks in Science (State Dept of Education) under  
:http://www.cde.ca.gov/cdepress/catalog/curriculum.html (see free downloads)  
Inclusion of All Students (Choate)

**Optional Texts:**

The Demon Haunted World (Sagan)  
The Structure of Scientific Revolutions (Kuhn)  
California Safety Manual in Science (State Dept. of Education)  
Use of Discrepant Events for Science Teachers (Keating)

**Schedule: approximately 7-8 seminars @ 3.0 hrs.each from 5:30-8:30**

**\*=Assignment/Reading due**

**Fall Semester:**

October 20 (Monday)

- syllabus
- introductions/ discrepant event presentation “Mystery Box”
- Go over assignments for next class : sign up for dates for DE (pairs), Science Frameworks jigsaw, readings from Text

October 27 (Monday)

- **\*Science Frameworks and Standards Jigsaw Assignment\***
- **\*Discrepant Events (two-three pairs present)**
- Go over assignments for next class: Readings due in Ch 1-2 (Nature of Science, History of Science Education )

November 10 (Monday)

- **\*Discrepant Events (two-three pairs)**
- **\*The use of Inquiry Based/Open ended science experiments (in class)**
- **\* Science Methods Textbook Discussion(Chap 1-2 due)\***

- Go over assignments for next class : Readings Ch 3 and 4

November 24 (Monday)

- **\*discrepant event presentations (two-three pairs)\***
- **\* discussion of science teaching observation sheet and science safety issues with master teacher**
- **\* Reading discussion due (Ch 3 and 4)\***
- Go over assignments for next class: readings Ch 9 (science safety); observation of science teaching; discussion notes from master teacher safety procedures

December 8 (Monday)

- **\*discrepant event presentations (two-three pairs)\***
- **\* Science Safety Manual or Flinn Scientific (see web site) (state dept of ed—optional), and discussion with master teacher (California), Readings Chapter 9 (Safety in the Lab)**
- **\* observation of science teacher assignment discussion (see handout)**
- Go over assignments for next class next semester (see notes for second semester)

Open date (but required): attend a science related informal or formal event or presentation equivalent in time and effort to one class session. This could be a field trip, museum, lecture or some other equivalent experience that will assist you either directly or indirectly in becoming a science teacher and write a one page summary (and give 1-2 minute presentation to the class when completed)

**Spring Semester: (Proposed Sessions)—During Intercession Read and prepare notes, comments, questions from Ch 5,6,7 for Ch 8 and 9; Chapter 10 Computers and Electronic Technology; Chapter 11 Managing the Learning Environment and Part Four (Assessment in Science); Ch 12-13 Planning for instruction; Chapter 14 and Part Five (Professional Development) Chapter 15 and Ch 13 in Choate: Science Instruction for Inclusion**

**Other assignments due that could be completed during intercession:**

- **\*Internet resources** for science evaluation (please review three sites and include 1) copies of URL and a representative page; 2) rating and rationale (1-5); 3) applicable to you as a teacher or your students; ( how would you use it)
- **\*Video resources (one taped science program)** bring and discuss 1) strengths and weaknesses; 2) rating and rationale (1-5) 3) potential application to science classroom
- **Science related personal reading** send title, other information including short summary/application and personal rating/review (due anytime during the semester)

Open date (but required): attend a science related informal or formal event or presentation equivalent in time and effort to one class session. This could be a field trip, museum, lecture or some other equivalent experience that will assist you either directly or indirectly in becoming a science teacher and write a one page summary (and give 1-2 minute presentation to the class when completed)

February \_\_16\_\_(Monday)

- **Discussion of ratings of Video resources and internet resources**
- **Ch 5, 6, 7, 8 and 9 Readings due**
- Go over assignments for next class: Ch 10; prepare for video-tape of science lesson due on April\_\_

February \_?\_(Monday) (no formal class meeting)

Option : Give out the three sets of new science software to preview (see me)

- **\*Independent viewing and evaluation of computer software** (see also SAS software site with license) at San Diego Co. Office of Education Computer Lab (Joe Rindone Center)—Linda Vista Drive

March \_1\_\_(Monday)

- **Discussion of Software resources from** Rindone Center and (or) SAS site or new software (**at least three**) bring and discuss 1) strengths and weaknesses; 2) rating and rationale (1-5) 3) potential application to science classroom
- **Discussion of Ch 10 (Technology and Science)**
- Go over assignments for next class: Ch 13 Choate; Science lab with SDAIE adaptation (and trial)

March\_15\_\_(Monday)

- **Science Lab modification and action research findings (SDAIE considerations)**
- Discussion of Choate Ch 13
- Go over assignments for next class: Ch 11, 12-13

Prepare an example of authentic assessment used in your student teaching

March\_\_22\_\_(Monday)

- Share an **\*example** of an **authentic assessment** (journals, portfolio, performance based exam etc.) that you have actually used this year in teaching science.
- Discussion of Ch 11, 12-13
- Go over assignments for next class: Ch 14-15;

April\_\_19\_\_(Monday)

- Enrichment activities for Science (Invention Convention, Odyssey of the Mind, Science Olympiad, Science Fair etc.)
- Discussion of Ch 14-15
- Discussion of High interest science related book reports (overview of already emailed reviews)

- Go over assignments for next class: NONE

May   3   (Monday)

- Debriefing of course/student teaching/jobs: meet at restaurant

**Assignments (by number)/Requirements:** (each will count as the points noted. The final grade for part a and b will be the % of total points earned that semester converted to a letter grade (90-100=A etc.) Assignments are due on time and will not be accepted late.

- 1) Attendance/participation (two pt. per class) (28 pts.)
- 2) Science Methods Text Readings/Discussion/Notes (12 pts) **TPE 1B, 2, 3,4, 5, 6c, 6d, 7, 9, 10, 11, 12, 13**
- 3) Jigsaw of science frameworks and standards (10pts). **TPE 6C, 12, 13**
- 4) Evaluation sheets on 3 computer programs (5 pts) **TPE 1B, 4, 5, 6C**
- 5) Evaluation of science internet sites (5 pts) **TPE 1B, 4, 5, 6C**
- 6) Inquiry---Discrepant event presentation(s) (10 pts) **TPE 1B, 2, 3, 4, 5, 6c, 6d, 7, 9, 10, 11**
- 7) Science lab SDAIE modification and action research presentation (10 pts) **TPE 1B, 2, 3, 4, 5, 6c, 6d, 7, 9, 10, 11**
- 8) Evaluation sheet for Science TV Program/ Video resources (5pts). **TPE 1B, 4, 5, 6C**
- 9) Observation of science lesson (5 pts) **TPE 1B, 2, 3, 4, 5, 6c, 6d, 7, 9, 10, 11**
- 10) Example of authentic assessment with rubric used in Science (5 pts ) **TPE 2,3,4**
- 11) Book Report on high interest science book (5 pts.) **TPE 12, 13**
- 12) Open ended attendance at science related event or site (5-10 pts)

Optional/Extra credit: (maximum 10 pts)

- 1) Directorship (5 pts.) **TPE 12, 13**
- 2) SDSEA or CSTA or other Conference in addition to open assignments (5 pts. one day) **TPE 12, 13**

Assignment Overview (by number)

**Assignment 1 Attendance** (each class counts 2 points) In the event of an absence any assignments due that night would receive only 50 % credit since you were not there to discuss (which is half the credit).

**Assignment 2 Science Readings in texts** (12 points) Each chapter is assigned a value of one point that includes your notes (summary of major points, reflections, questions) that you credit yourself (honor system)

**Assignment 3 – California Science Framework and Standards** (10 pts)

Spirit of the assignment: to read a portion of the California Science Framework and the Standard for a particular science subject area grade 9-12. You will write your individual response to the readings. Then you will work with your grade level team to prepare and do a presentation to the class. It's important that you do the reading and the write-ups BEFORE you meet with your team.

- 3a Framework summary response 3 points
- Read the first part of the California Science Framework, up to page 20. These include Board Policy, the Introduction and Chapters One, Two and Three (only high school and only your chosen subject area) and choose another chapter (so that each chapter in the framework is covered for your group).
  - Think about the reading holistically.
  - Write about a page, in your own words, that answers these questions: What do you think are the most important ideas addressed in the reading? Were there any ideas in the reading which were very new to you, and (or) which disagreed with something you thought?
- 3b Grade level Science standard response 2 points
- Using the standard for your chosen subject,(assume a general course) pick a line item from physical science, life science, and earth science. For each one, come up with a brief description of an activity that students in that subject area can do that also addresses one of the Investigation and Experimentation standards for the subject.
  - You should end up with four sections, 1) includes a content standard line (physical, life, or earth science), 2) an Investigation and Experimentation line, 3) a one or two sentence description of an activity that combines the two; 4) how you might incorporate the ideas in your individual team chapter which you read in the lesson plan which your team will develop. The whole thing should be about a page.
- 3b. Team preparation and presentation 5 points
- Get together with your team by subject area (chemistry, physics, biology or earth science). Look at the activities that everyone wrote up for Assignment 2b. Choose one.
  - As a team, write up a lesson plan for the activity (with objectives, activities, assessment, the works). This lesson plan should also try to integrate the ideas from the individual team chapters 4-11. Put it on chart paper or an overhead transparency so it can be easily presented to the class.
  - As a team, think about the entire set of standards for the subject area. If you only had time, as a teacher, to do half of it with your kids, which half would you do, and why? Make a list to present to the class, and be prepared to give your reasons for your choices.
  - In 8 minutes or less, present your creative lesson plan and standards choices. Be prepared to explain why your science lesson plan represents a standards based, student centered, inquiry based concept and why your chose the particular lines or sections from the standards to teach.

**Assignment 4 (Internet Sites) (5pts) Assignment 5 ( Software ) (5pts) and Assignment 8 ( Science Television or video) (5 pts) (evaluation of science technology resources)**

Spirit of the Assignments: individually explore potential internet, software and video science resources; rate them and provide feedback to classmates regarding their potential use.

For assignment 4 an 5 resources explore in detail at least three sites and three software sources and for assignment 8 one video resource and prepare the following for each:

- 1) name/ access information (so someone else can access)
- 2) rating 1-5 with justification for use by teacher, student (appropriateness for what subject or level)
- 3) how would you use it
- 4) electronic documentation so the technology director can collect and send complete copies to all

### **Assignment 6: Inquiry based Discrepant Event Presentation (10 pts)**

Spirit of the Assignment: to develop and teach a particular kind of a science inquiry lesson that teaches both science thought processes and science content. You will practice your discrepant event on at least one school-age child and reflect on the child's responses and what they indicate about how much he/she understood. Working by yourself or with a partner you will actually present your discrepant event to the class and give a copy of the lesson plan to each class member. After all the discrepant events have been presented, you will take a quiz to demonstrate that you personally learned the important science concepts that were presented.

- 6a. Discrepant Event Lesson Plan and Presentation 5 points
- Working by yourself, or with a partner, find a discrepant event to do. You can get one from Discrepant Events, by Keating, or go to a bookstore or the children's section of the library and look for books on Science Tricks, or Science Magic.
  - Get together the materials needed for the discrepant event. (If you can't get certain things, look for another event to do.)
  - Practice doing the event. (If you can't get it to work, you may need to find another event to do.)
  - Make sure you understand the science behind the event. If you got it from an internet website, there may be background info on the site. Another good place to look: the children's section of the public library. Find children's books on the topic in addition to or even preferably to books for adults. The children's books will explain things simply and will use the appropriate vocabulary for you to use with your students. Remember, you don't have to have a college-level understanding of the topic, just have good, accurate information at your students' level.
  - Do your discrepant event with at least one school-age child and take careful notes on the child's responses. (This ties in with Assignment 6b.)
  - Fill in the discrepant event cover sheet, including the two questions.
  - On your assigned day, bring in your materials and equipment and do your discrepant event for/with the class. You are limited to 15 minutes presentation time.
  - After presenting your event, give each member of the class a copy of the lesson plan.
  - Turn in your lesson plan, the cover sheet and your individual journal.
- 6b. Discrepant event journal 5 points
- After you have done your discrepant event with a child or children, 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 the class.)
  - Write a description of what happened, with special attention to what the child said and did. Analyze the child's response: what portions of the event, and to what extent, did the child understand what was happening? Why or why not?

### **Assignment 7: Science lab SDAIE modification (and action research findings) (10 pts)**

Spirit of the Assignment: take an existing science lab or activity and rewrite it to be more appropriate for understanding particularly by second language learners. Evaluate using action research model by comparing outcomes of experimental (SDAIE) with control (original lab or activity). See suggested ideas in Keating, Aztec press customized text for Schools of the 21<sup>st</sup> Century and Choate Ch 13.

For the assignment: Use the SDAIE lab or activity you have prepared and incorporate it into a class during student teaching and compare it to outcomes in the original lab or activity (3 pts) and 1) bring overhead copy of original science lab or activity and revised lab (2pts ); 2) List of changes/ adaptations you made (2pts ); 3) Incorporate a simple action research evaluation by comparing two classes one who used original lab (control) and another who used modified lab (experimental). Compare the success of the two using such tools as teacher observations, focus groups, student assessment of understanding, Quickwrite and discussions. Discuss briefly your findings (3 pts).

**Assignment 9 Observation of science lesson (5 pts)**

Spirit of the assignment: to intelligently observe a science lesson. During your observation/participation time you will find a teacher who is teaching science (this may or may not be your own master teacher). You will interview the teacher before and after the lesson. If possible, it's good to also talk with some of the students after the lesson. You will put those responses together with your own observations and conclusions to write your report. **DON'T JUST GIVE BRIEF ANSWERS TO THE BULLETS – WRITE A REPORT THAT CAN BE READ.**

GENERAL INFORMATION: grade level, district, description of the activity.

**BEFORE (Interview)**

- How did the teacher come to do this lesson?
- How did he/she pick the topic?
- Where did the materials come from?
- In general, how does the teacher think the children will respond to the lesson?
- Name three children in the class who will like this lesson and do well on it.
- Name three children who might have difficulty, either cognitive or behavioral and describe the problems they are likely to have.

**DURING (observation)**

- Is there a written or unwritten plan for this lesson?
- What are the objectives (if this/these are unstated, you will have to figure them out)
- How does the teacher know that the objectives were met at the end of the lesson?
- How does the teacher know as the lesson is going on whether the kids are getting it? (checking for understanding)
- Does the teacher make any adaptations to address the needs of the children who might have difficulty?
- Can you clearly follow the procedures the teacher is using and do they relate directly to the objectives?

**AFTER (interview teacher, and if possible, some kids)**

- How did the lesson go?
- Did the teacher correctly predict the performance of specific children?
- Did the adaptations (if there were any) work?
- How about the class as a whole – were the children engaged?
- Did they learn the skills or content? Did they get it?
- How does the teacher know whether they got it or not?
- Were there any logistical problems?



If you taught this lesson, how would you change it? (Include as many things as you can think of. Even if the lesson was wonderful, come up with at least one modification of your own.) Remember, there is no such thing as a perfect lesson.

**Assignment 10 Demonstration of an example of authentic assessment with rubric used in Science (5 pts )**

Spirit of the assignment: prepare an authentic assessment and rubric to score that you actually used in a science lesson (s). Describe the strengths and challenges that you found in using this as an assessment.

For this assignment be prepared to discuss and include as part of the discussion: 1) a copy of the actual lesson plan; 2) a copy of the assessment you used (with student outcome examples if possible); 3) a brief overview of the strengths and challenges of this assessment (for the teacher and for the student)

**Assignment 11 Book Report on high interest science book (5 pts.)**

Spirit of the assignment: read a new book in fiction or non-fiction that you would like to read for general interest, deep background or for inclusion in your own class. By reading yourself you increase the likelihood that you will include science reading as part of the curriculum for your own students. Share this electronically with your classmates.

For this assignment read, summarize, rate (1-5 with justification) and make recommendations on how you might incorporate into your teaching either directly indirectly. Share this formal review electronically with instructor and classmates as well as during general class discussion on \_\_\_\_\_.

**Assignment 12 Attendance at a formal or informal science event, presentation or site (5pts-10 pts)**

Spirit of the assignment: by attending formal or informal outside events a science teacher is more likely to encourage their own students to seek out such events and include them as part of their curriculum.

For the assignment: after having completed assignment 12 write up a brief report summarizing it and either present in class or send via email.