

**EDSS 545 a and b Secondary Science Methods  
(4.0 Credits) 2005-6**

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**Location:** UH 458

**Description/ Goals:** This course will be held both first and second semester for a total of 4 credits (approximately 30 contact hours per semester, 2 credits 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) inclusive science education methods including SDAIE 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 10 Instructional Time

### **Required Texts:**

Science Instruction in the Middle and High School (Chiappetta and Koballa)  
(2006 Sixth Edition)

Use of Discrepant Events for K-12 Science Teachers (Aztec Press, Keating)

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) Used in other courses already

### **Optional Texts:**

The Demon Haunted World (Sagan)

The Structure of Scientific Revolutions (Kuhn)

California Safety Manual in Science (State Dept. of Education)

**Schedule: approximately 20 seminars @ 10 seminars per semester @ 3.0 hrs.each  
from 5:30-8:30 (fall semester) and (spring semester)**

### **Attendance and Punctuality:**

Both are essential to completing all work satisfactorily. Only 50% of the potential value for an assignment can be credited for an assignment due and reviewed in a class that was missed including. Two absences in one semester will result in a minimum of one grade lower, Three absences will result in a non-passing grade (unless there are extenuating circumstances). Late arrivals will be penalized at the discretion of the instructor.

**\*=Assignment/Reading due**

### **Fall Semester:**

#1 August 29 (Monday)

- **\*Read syllabus and ask questions**
- introductions/ discrepant event presentation “Mystery Box”
- Go over assignments for next class including format for text reading assignments : sign up for dates for DE (pairs), Science Frameworks jigsaw, readings from Text

#2 September 12 (Monday)

- **\*Science Frameworks and Standards Jigsaw Assignment\* #3 a-c**
- **\*Discrepant Events (two-three pairs present) #6 a-b**
- Go over assignments for next class: Readings due in Ch 1-2 (Nature of Science, History of Science Education )

#3 September 26 (Monday)

- **\*Discrepant Events (two-three pairs) #6 a-b**
- **\*The use of Inquiry Based/Open ended science lab experiments (in class)**
- **\* Science Methods Textbook Discussion (Chap 1-2 due)\* #2**
- Go over assignments for next class: Readings Ch 3 and 4 and 7

#4 October 3 (Monday)

- **\*Discrepant event presentations (two-three pairs)\* #6 a-b**

- **\* Discussion of assignment requirements for science teaching observation sheet and science safety issues with master teacher**
- **\* Science Methods Textbook Discussion (Ch 3 and 4 and 7)\* #2**
- Go over assignments for next class: be prepared to reflect and analyze issues from student teaching (write down notes/comments to use)

#5 November 7 (Monday) Remote Distance Learning (meet in lab)

- Issues in student teacher (be prepared to be specific)
- **\*Discrepant event presentations (two-three pairs)\* #6 a-b**
- Go over assignments for next three classes (WAP Field Trip #13, Science safety manual and Flinn safety manual (read/notes/questions), observation of science teacher assignment #9a, discussion of safety issues with master teacher assignment #9b, and Ch 14 (Science Safety))

#6-7 December 4 (Saturday 9-3 at Wild Animal Park) Assignment #13

- Resources available at park and for school sites
- Implementation and analysis of grade level WAP curriculum guides
- Strategies for doing animal observation studies

#8 December 5 (Monday)

- **\* Science Safety Manual or Flinn Scientific (see web site) (state dept of ed—optional), and**
- **Discussion of safety issues with master teacher #9b,**
- **\*Reading Chapter 14 (Safety in the Lab) #2**
- Issues in student teacher: action plan findings (be prepared to be specific)

#9 December 12 (Monday)

- **\* Observation of science teacher assignment discussion (see handout) #9a**
- **\*Discrepant event presentations (two-three pairs)\* (if needed) #6 a-b**
- Issues in student teacher: action plan findings (be prepared to be specific)
- Instructor evaluations

#10 To be completed during the semester

A) Open date (but required by end of semester) Assignment #12: attend a science related informal or formal event or presentation equivalent in time and effort to one class session (3 hrs). 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). This report and oral presentation should include a summary of what you learned and how you will use it to help you in your own teaching.

B) Practicum/research (time outside class): During student teaching or observation/participation (at site). Use time outside of formal class meetings for the following field assignments as outlined in the syllabus (theory to practice): 1) Discrepant

trial analysis and write-up; 2) Science Safety observation and interview with master science teacher; 3) Science teacher observation

**Spring Semester: (Proposed Sessions times TBA)—During Intercession Read and prepare reading logs, comments, questions from these nine (9) Chapters from Koballa Ch 5,6, 7, 8; Ch 11 Using lecture as a strategy in science and Part Four (Assessment in Science); Ch 12 Science Technology and Society; Ch 14 and Part Five (Professional Development) and Ch 15 Technology**

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

- **\*Internet resources #4** for science evaluation (please review three sites and include 1) copies of URL and a representative page; 2) justifiable rating and rationale (1-5); 3) applicable to you as a teacher or your students;
- (how would you use it)?**\*Video resources #8 (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 #11** send title, other information including short summary/application and personal rating/review (due anytime during the semester) Discussion in class in class # 6

#### **#1 January 23 (Monday)**

- Debriefing of Student Teaching
- Review syllabus for second semester
- \*Discussion of ratings of video resources #8 and internet resources #4
- \*Ch 5 Managing Environment, Ch 7 Nature of Science Reading logs/ discussions due #2
- **Next time:**
- Go over assignments for next class: Ch 8 Diversity and 10 Inquiry and 11 (Lecture)
- Prepare lesson on current topic in science for brief lecture next time (aligned with Ch 11 Lecture Strategy) Assignment #14

#### **#2 February 6 (Monday)**

- Ch 8 Diverse Students and Ch 10 Inquiry Based Learning
- Presentation of Current Topic in Science in a mini –lecture (Assignment #14)

**Next time:**

- **Assignment #5 (revised from original syllabus) Research/review Lucas and Annenberg Best Practices in Teaching video sites and choose any three do a brief review per the description in the Assignments section for #5 for a class presentation.**

#### **#3 February 20 (Monday)**

- **Discussion of three Best Practices in Science Teaching from Annenberg and Lucas Web site resources # 5:** bring and discuss 1) strengths and

weaknesses; 2) rating and rationale (1-5) 3) potential application to your science classroom

- **Discussion of Ch 8 Diversity (SDAIE) and Ch 10 (Inquiry Review) #2**
- **Go over assignments for next class:**
- Science lab with SDAIE adaptation (and trial). Prepare lab next time with appropriate SDAIE modifications (research and follow up findings due \_\_\_\_\_)
- Chapter 6 Assessment in Science

#### **#4 February 27<sup>th</sup> (Monday)**

- Enrichment activities for Science (Invention Convention, Odyssey of the Mind, Science Olympiad, Science Fair etc.)
- Bring and present SDAIE modified science lab that will be used in conjunction with Assignment #7
- Discussion of Chapter 6 Assessment (Linkage to Assignment #10 see below)
- **Go over assignments for next class:**
- Read/Reading log Ch 12 Science Technology and Society (Integrating Science as a Discipline) and Ch 15 Use of Technology in Science
- Assignment #10 . As part of the student teaching: you will design and use an authentic assessment and compare to a more traditional assessment (action research) for the lesson (using a control and experimental). Note: For next class bring authentic instrument (experimental) and traditional instrument (control) you plan on using in your action research study. Your final summary report will include: lesson plan, both assessment forms and findings from this action research project. Final Report due \_\_\_\_\_

#### **#5 March 20 (Monday) Video Conference in Room (TBA)**

- Issues in Science Student teaching
- Presentation of instruments (traditional and authentic ) that you will use in conjunction with action research for Assignment #10
- Discussion of Ch 12 Science Technology and Society and Ch 15 Use of Technology
- **Review assignments due for next class:**
- SDAIE lab modification (#7); and
- Use of Authentic Assessments in Science (#10)

#### **#6 April 10 (Monday) Video Conference in Room (TBA)**

- Issues in Science Student Teaching
- Science Lab modification and action research findings (SDAIE considerations) #7
- Action research findings on the use of Authentic Assessments in Science (#10)
- **Discussion of High interest science related book reports #11** (overview of already emailed reviews)
- Go over assignments for next classes: Open date assignment (#12) (May 8<sup>th</sup>) and Reuben Fleet Field Trip (May 6)

#### **#7-8 May 6 Saturday 9-3 (Field Trip to Ruben Fleet Museum)**

- How to organize a field trip in a museum like environment
- Resources at Ruben Fleet

### **#9 May 8(Monday)**

- Issues in Science Student Teaching
- Reports on open date assignment (#12)
- Go over assignments from last class: Field Trip to Reuben Fleet museum
- Discussion of High interest science related book reports #11 (overview of already emailed reviews)
- Instructor evaluations (TPE considerations)

**#10 Open date Assignment #12** (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). This report and oral presentation should include a summary of what you learned and how you will use it to help you in your own teaching.

Note some of the assigned time for the class will be in the nature of a Practicum/research Assignment: During student teaching or observation/participation (at site). Use time outside of formal class meetings for the following field assignments as outlined in the syllabus (theory to practice): 1) Resource search and evaluation of internet and video resources; 2) Science lab modification design and findings from action research study; 3) Application of authentic vs. traditional assessment (design of instruments and findings from action research study).

**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) (40 pts.)
- 2) Science Methods Text Readings/Discussion/Notes (12 readings @ 3pts. =36 pts)
- 3) Jigsaw of science frameworks and standards (10pts)
- 4) Evaluation sheets on 3 best practices in Science video's (5 pts)
- 5) Evaluation of science Internet sites (5 pts)
- 6) A-c Inquiry---Discrepant event presentation(s) (10 pts)
- 7) Science lab SDAIE modification and action research findings (10 pts)
- 8) Evaluation sheet for Science video or TV resources (5pts).
- 9) a-b Observation of science lesson and evaluation of science safety strategies (10 + 5 pts = 15 pts.)
- 10) Example and implementation of authentic assessment that uses a rubric and comparison to traditional assessment (action research findings) (10 pts)
- 11) Book Report on high interest science book (5 pts.)
- 12) Open ended science related event or site both semesters (10 @ 2 =20 pts)

13) Strategies for implementing field trips at the high school level (WAP visit and Reuben Fleet Museum 2@ 15 pts = 30 pts.

14) Researching and presenting a current topic in science = 10pts.

Optional/Extra credit: (maximum 10 pts)

1) Directorship (5 pts.)

2) SDSEA or CSTA or NSTA or other Conference in addition to open assignments (5 pts. one day)

**Point's summary:**

**Fall Semester: Assignments #1 (20 pts); #2 (15 pts); #3 (10 pts); #6 (10 pts); #9 a-b (10+5); #12 (10 pts); #13 (15 pts) = 95 pts. Total**

**Spring Semester: Assignments #1 (20 pts); # 2 (27 pts.); #4 (5 pts.); #5 (5 pts.); #7 (10 pts.); #8 (5 pts.); #10 (10 pts.); #11 (5 pts.); #12 (10 pts.); #13 (15 pts); ##14 (10 pts) = 122 pts. Total**

**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 % of the potential credit since you were not there to interact and discuss this assignment.

**Assignment 2 Science readings in texts** (36 points) Each chapter is assigned a value of three points that includes your notes (summary of major points, reflections, questions) and discussion of these with your colleagues. This is done using the honor system i.e. credit yourself.

**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 those 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 you chose the particular lines or sections from the standards to teach.

**Assignment 4 (Internet Sites) (5pts) Assignment 5 (Best Practices in Science Videos) (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 explore in detail at least three internet sites; for assignment #5 explore the Annenberg and (or) the Lucas internet site for Best Practices in Science Teaching (Look at least three) and for assignment #8 one video/DVD 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 the 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 in 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, and student assessment of understanding, Quickwrite and discussions. Discuss briefly your findings (3 pts).

**Assignment 9 a-b Observation of science lesson (10 + 5 pts= 15 pts)**

Spirit of the assignment: a) 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 guidelines for completing 9b:** As part of the interview ask the master teacher to describe how they deal with safety issues in their course. This should include as a minimum: lesson plans they use to teach safety, lab safety contract, general rules used, and any general experiences in dealing with science safety.

**General guidelines for completing 9 a:**

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 Comparison of the use of authentic assessment vs. traditional assessments in Science (10 pts)**

Spirit of the assignment: prepare both an authentic and traditional assessment and their rubrics and implement them in an actual science lesson. Design an action research plan to evaluate the findings. 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 assessments and rubrics you used (with student outcome examples if possible); 3) the findings that present that include a brief overview of the strengths and challenges of using each of these assessment (for the teacher as well as 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 for class # 5.

**Assignment 12 Attendance at a formal or informal science event, presentation or site (10 pts each semester 20 pts in all)**

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. After having completed assignment # 12 write up a brief report summarizing it and how you might use it in your teaching 1) do a 1-2 minute presentation in class and 2) send an electronic copy to all via email.

**Assignment 13 Attendance at a field trip to the Wild Animal Park (15 pts)**

Spirit of the assignment: by attending this field trip students will: 1) general procedures for planning an implementing a field trip in science; 2) how to access and use resources provided by a site prior to going; 3) Pre, during and post lesson plans using a) prepared curricular materials at a field site; b) teacher developed and implemented teaching curricular plans (this example uses an animal observation study)

**Assignment #14 Researching a current issue or topic in science and presenting a mini-lecture in class on that topic (10 pts).**

The spirit of the assignment is to practice researching (outside the textbook) a current issue or topic and applying some of the concepts from Chapter 11 (Using lectures in science) present a 10-minute mini-lecture to the class.