

**EDSS 545 A and B Secondary Science Methods
(4.0 Credits) Fall and Spring 2006-7**

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Location: UH 460 at 5:30-8:30 unless noted

Description/ Goals: This course will be held both fall and spring semesters for a total of 4 credits (approximately 30 contact hours per semester, 2 credits per semester). It fulfills the requirement for a methods course for all Single Subject Science credential students. 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 from knowledge of state and national frameworks and reform documents. Using this knowledge as a framework, he (she) will be able to apply multiple strategies and resources for the development of unit plans, instructional delivery and assessments that utilize a student-centered, inquiry (problem-solving) and community based approach to the teaching of science for all students.

Major Themes/Objectives: (the student will gain 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 strategies for the incorporation of other disciplines into the science curriculum (interdisciplinary curriculum).
- 6) Inclusive science education strategies including SDAIE that enhance the science curriculum for all learners.
- 7) An inquiry-based curriculum that is cognitively sound in addressing science content knowledge.

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: Classes will consist of formal class meetings, field trips, video conferences and independent study totaling approximately 20 seminars @ 10 seminars per semester @ 3.0 hrs.each from 5:30-8:30

Attendance and Punctuality:

Both are essential to completing all work satisfactorily. Only 50% of the potential value for an assignment can be credited as makeup for an assignment that is due and reviewed in a class that was incomplete or missing (or not attended by the student). Two absences in one semester can result in a minimum of one grade lower. Three absences can 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 EDSS 545 A:

#1 September 11 (Monday)

- ***Read syllabus and ask questions**
- Class introductions
- Introduction to discrepant event (DE) model through presentation “Mystery Box”
- **Next time:** (to be discussed in class); 1) format procedure for Reading Logs for text reading assignments; 2) sign up for dates for DE (pairs); 3) Science Frameworks jigsaw assignment; 4) readings from Text (Ch 1 and 2) (see above Reading logs)

#2 September 18 (Monday)

- ***Science Frameworks and Standards Jigsaw Assignment* #3 a-c**
- ***Discrepant Events (two pairs present) #6 a-b**
- *** Discussion of Readings/Reading Logs in Text Ch 1-2**
- **Next time:** Read and prepare reading logs for Ch 3 and Ch 4

#3 September 20 (Wednesday)

- ***Discrepant Events (two pairs) #6 a-b**

- ***The use of Inquiry Based/Open ended vs. Closed ended science lab experiments “Paper Towel Experiment” (in class)**
- *** Discussion of Readings/Reading logs in Text (Chap 3-4 due)* #2**
- **Next time:** Reading logs for Ch _ and Ch _

#4 October 2 (Monday) **Video Conference in UH 460**

- ***Discrepant event presentations (two pairs)* #6 a-b**
- Discussion of assignment requirements for science teaching observation sheet and science safety issues with master teacher
- *** Discussion of Readings/Reading logs for (Ch _ and Ch _)* #2**
- **Next time:** (October 30 Class # 6): Reading logs for Ch_ and Ch_

#5 October 16 or whenever scheduled by you. **No formal meeting: Independent Study**
To be completed before class #10 during this 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. Your choice!! To complete this requirement: 1) complete a one-page summary with applications to teaching; 2) send by email to all of us; 3) do a 1-2 minute presentation to the class during class #10. The report and oral presentation should include a summary of what you learned and implications for your own teaching.

#6 October 30 (Monday) **Video Conference in UH 460**

- ***Discrepant event presentations (two pairs)* #6 a-b**
- *** Discussion of Readings/Reading logs for (Ch _ and Ch _)* #2**
- Discuss use of Case Study Model for Assignment #15
- **Next times:** Go over assignments for next four classes: 1) WAP Field Trip #13, 2) Science safety manual and Flinn safety manual and Ch 14 Science Safety (read/notes/questions) development of Plan for Science Safety assignment #16; 3) observation of science teacher assignment #9a which also includes discussion of safety issues with master teacher assignment #9b; 4) Prepare a Case Study Model (Assignment #15) for some issue(s) during beginning student teaching

#7 November 20 (Monday)

- **Discussion of individual Case Study Models/ Proposed Action Plans for Student teaching issues (Assignment #15)**
- ***Discrepant event presentations (two pairs)* #6 a-b**
- *** Discussion of Teacher Observation Assignment #9a**
- Discussion/Preparation for WAP field trip/ visit WAP Web page
- **Next time:** Visit web page prior to field trip. Meet at WAP at 8:45 for field trip. Bring notebooks, cameras etc.

#8-9 December 2 (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
- **Next time: 1) Science safety: readings (Flinn, State Dept, Ch.14); 2) Presentation of Plan for Science Safety; 3) Case Study action plan outcomes**

10 December 6 (Wednesday)

- Discussion/Questions from **Science Safety Manual or Flinn Scientific (see web site) (California State Dept of Ed—optional)/Ch 14**
- ***Discussion of safety issues with master teacher #9b**
- ***Presentation of Plan for Science Safety #16**
- ***Case study action plan outcomes/discussion of issues in student teacher: action plan findings (be prepared to be specific) #15**
- Instructor Evaluations

Spring Semester: (Proposed Sessions/ times TBA) assignments due this semester that should 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; i.e. how would you use it)?
- ***Video resources #5 (Annenberg/Lucas/Video/DVD)** bring and discuss three resources from above 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.

Assignments for EDSS 545 A and B (by number)/Requirements:

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 penalized heavily if completed late.

- 1) Attendance/participation (5 pt. per class) (100 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-B Inquiry---Discrepant event reflection/ presentation(s) (10 pts)
- 7) Science lab SDAIE modification and action research findings (20 pts)
- 8) Development of an outline for a Plan for Science Safety (10 pts)
- 9) A-b Observation of science lesson and evaluation of science safety strategies (10 + 5 pts = 15 pts.)
- 10) Development and implementation of authentic assessment and comparison to traditional assessment (action research findings) (20 pts)
- 11) Book Report on high interest science book (5 pts.)

- 12) Open ended science related event 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.
15) Two Case Studies per semester: Issues in student teaching and proposed action plans =(5 +5=10 pts @2 =20.)

Point's summary for EDSS 545 A and B:

**EDSS 545 A: Fall Semester: Assignments #1 (50 pts); #2 (30 pts); #3 (10 pts); #6 (10 pts); #8 (10 pts) #9 a-b (10+5); #12 (10 pts); #13 (15 pts); #15 (10 pts); = 160 pts.
Total**

EDSS 545 B: Spring Semester: Assignments #1 (50 pts); # 2 (6 pts.); #4 (5 pts.); #5 (5 pts.); #7 (20 pts.); #10 (20 pts.); #11 (5 pts.); #12 (10 pts.); #13 (15 pts); #14 (10 pts); #15 (10 pts) = 156 pts. Total

Overview of Assignments (by number):

Assignment 1 Attendance (each class counts 5 points) In the event of an absence any assignments due that night could receive only 50 % of the potential credit (if made up) since you were not there to interact and discuss the 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.

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

Spirit of the assignment: How to teach science to all students by understanding how to apply standards to an inquiry based curriculum appropriate to a subject area to read a portion of the California Science Framework and the Standard for a particular science subject area for grades 9-12. You will write your individual response to the readings. Then you will work with your subject 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
- Individually: Read the California Science Framework. For the standards chapters read only the subject area standards for high school subject area (9-12) that you are assigned i.e. Physical Science, or Life Science or Earth Science Think about the readings holistically.
 - Write about a page for the non-standards chapters, in your own words, that answer 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 have a question about (or) which you disagreed?

- 3b **Science subject standards response (only your subject area)** 2 points
- Using the standard for your chosen subject, (assume a general course) pick one standard from physical science, or life science, and or earth science. 1) Choose and write the standard; 2) come up with a brief description of an activity those students in that subject area can do and 3) state which Investigation and Experimentation standard it address for that subject.
 - In addition, 4) write a short paragraph on how this lesson might incorporate other ideas discussed in other chapters in the California Frameworks. For example, one chapter addresses the use of technology in science. Your lesson might incorporate the use of a remote data recorder for pH in a stream environment and using this data to graph the outcomes on a computer. You might have to receive professional development training (another chapter in Frameworks) to learn how to use the remote data recorder and the graphing software. Both of these ideas might be addressed in this section
- 3c. 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 that your team feels is the best representation of the application of the standards/frameworks
 - As a team, write up a lesson plan for the activity stating the standard(s) (with objectives, activities, assessment,). This lesson plan should also try to integrate the ideas from the individual team chapters 4-11 as discussed in 3b above. 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 students, 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.

Assignments 4 and 5 (Evaluation and Use of Technology Resources)

Assignment 4 (Internet Sites) (5pts);

Assignment 5 (Best Practices in Science Videos) (5pts)

Spirit of the Assignments: individually explore Internet 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 and one video/DVD resource and prepare the following for each (three in all):

- 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 sciences thought processes and science content. You will practice your discrepant event on at least middle or high school age student 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.
- Do your discrepant event with at least one middle or high school age student and take careful notes on the student's responses. (This ties in with Assignment 6b.)
- Present your DE to the class. (You may discuss your findings from the pre-event DE with the student as part of this presentation. You are limited to 15 minutes presentation time.
- After presenting your event, give a copy of the DE lesson plan to each member of the class your individual journal to the instructor (see 6B)

6b. Discrepant event journal (Reflection on Pre-Event) 5 points

- After you have done your pre-event discrepant event with a student, 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 student said and did. Analyze the student's response: what portions of the event did the student understand (not understand) what was happening? Did they understand the underlying science concept? What modifications to what you say or do might be necessary for better understanding?

Assignment 7: Science Lab (SDAIE) modification using the action research model (20 pts)

Spirit of the Assignment: take an existing science lab or activity and rewrite it to be more appropriate particularly by second language learners (use SDAIE techniques). Evaluate

using the action research model by comparing outcomes of experimental lab (SDAIE) with control (original lab or activity). See suggested for ideas in Choate Ch 13.

For the assignment: Use the SDAIE lab or activity you have prepared and incorporate it into a class during advanced student teaching and compare it to outcomes from a control class using the original lab or activity (10 pts total). For your presentation: 1) bring overhead copy of original science lab or activity and revised SDAIE lab (6pts); 2) List of changes/ adaptations you made (4pts); 3) Design an action research proposal using the design explained in class. This will be presented prior to implementation in class for input from classmates and instructor (5pts). 4) Present the findings (triangulated data) by comparing various outcomes from the two lab classes one, which used original lab (control) and another who used the modified SDAIE lab (experimental). Some tools for measuring the success (lack of success) of the lab approaches might be: teacher observations, focus groups, and student assessment of understanding, Quickwrite and class discussions. Discuss briefly your findings (5 pts).

Assignment 8 Readings in Science Safety (Flinn/California State Dept.) and Development of a personal outline Plan for Science Safety (10 pts)

Spirit of the Assignment: Use your readings from the safety manuals/documents and interview with the science teacher to propose an outline of a **Plan for Science Safety** that you will (can) use within your science discipline. This might include: safety contracts, demonstrations, laboratory protocols, etc.

Assignment 9 a-b Observation of science lesson and teaching strategies and use of science safety within the curriculum (10 + 5 pts= 15 pts)

Spirit of the assignment: to intelligently observe a science lesson. During your observation/participation time you will find a science teacher who may or may not be your own master teacher. You will 1) 9A: interview the teacher before and after the lesson. If possible, it's good to also talk with some of the students after the lesson (see guidelines for 9a below (10 pts); 2) 9B: address with the teacher the specifics of how she (he) approaches science safety. This might 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). Collect samples if you can and include what you would do in your classroom to address science safety (5 pts). You will put both of these responses (9A-B) together with your own observations and conclusions to write your report.

General guidelines for completing 9 a (10 pts):

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 students will respond to the lesson?
- Identify some students in the class who will like this lesson and do well on it.

- Identify some students who might have difficulty, either cognitive or behavioral and describe the problems they are likely to have and how the teacher might adapt for them

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 (formative or summative assessments)?
- How does the teacher know as the lesson is going on whether the students are getting it? (Formative i.e. checking for understanding)
- Does the teacher make any adaptations to address the needs of the children who have difficulty?
- Can you clearly follow the procedures the teacher is using and the understanding of the science concept and do they relate directly to the objectives?

AFTER (interview teacher, and if possible, some students)

- How did the lesson go?
- Did the teacher correctly predict the performance of specific students?
- Did the adaptations (if there were any) work?
- How about the class as a whole – were the students engaged?
- Did they learn the skills and or content?
- 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.

General Guidelines for completing 9B (5pts) (Science Safety in the Science Curriculum)

Address with the teacher the specifics of how she (he) approaches science safety. This might 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). Collect samples if you can 9B and include your own comments on what you would do (5 pts).

Assignment #10: Comparison of the use of authentic assessment vs. traditional assessments in Science using the Action Research model (20 pts)

Spirit of the assignment: During advanced student teaching prepare both an authentic and traditional assessment (that address the same standards and science content) and include their rubrics and implement them in an actual science lesson. Design an action research plan to evaluate the findings comparing two classes (control and experimental). 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 two types of assessments and rubrics you used (with student outcome examples if possible) (10 pts); 3) action research design proposal that incorporates at three instruments (triangulation) (5pts) 4) the triangulated

findings/outcomes (data) comparing the two assessment approaches that include a brief overview of the findings as well as the strengths and challenges of using these instruments (for the teacher as well as for the student) (5pts)

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 the general class discussion.

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 (Fall 15 pts) and Reuben Fleet Science Museum (Spring 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 curricular plans

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

Assignment #15 Issues in Science Student Teaching (Case Study Approach): both semesters (10 pts each semester)

The spirit of the assignment: Share issues/ problems/solutions to various scenarios that occur during beginning and advanced student teaching related to curriculum, teaching strategies and classroom management. The Case Study Model used will be discussed in class and used as an approach to address real solutions and subsequent outcomes from these action plans. One written Case Study will be required each semester. (5 +5=10 pts @2 =20.)