

CALIFORNIA STATE UNIVERSITY, SAN MARCOS
COLLEGE OF EDUCATION
EDSS 545 B Secondary Science Methods
(2.0 Credits) Spring 2012

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Location: UH 460 at 5:00-8:00 on Monday (note syllabus for a few exceptions on Saturday)

School of Education Mission Statement

The mission of the School of Education Community is to collaboratively transform public education by preparing thoughtful educators and advancing professional practices. We are committed to diversity, educational equity, and social justice, exemplified through reflective teaching, life-long learning, innovative research and on-going service. Our practices demonstrate a commitment to student-centered education, diversity, collaboration, professionalism, and shared governance. (*Adopted by COE Governance Community, October, 1997*).

Course Prerequisites: Admission to the Single Subject Program or pursuit of a single subject add-on credential (by permission) is required to enroll in this course.

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 standards based science course in the secondary school in a manner that is exciting, creative and rigorous. To accomplish this, the candidate will formulate a personal framework of science education based on both a historical/philosophical perspective as well as from knowledge of the state and national frameworks and other reform documents. Using this knowledge as a framework, he (she) will learn 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.

Course Objectives: **These Objectives will be measured and tied directly to the assessments in the course (see description of assignments and assignments of point value. In general terms, a successful candidate should know and be able to apply the following at the completion of the course:**

i.e. the student will gain a broad perspective and practice in using.....

- 1) the major frameworks, programs and standards for Science Education in California, the United States as well as international countries (TIMSS Study)
- 2) the history and philosophy of science education
- 3) diverse resources, materials available for science education including texts, lab manuals as well as technological and community related resources

- 4) methods of safe and effective science teaching
- 5) methods of integrating technology into science teaching,
- 6) Effective methods in various teaching strategies such as expository teaching; inquiry-based learning; the use of open-ended laboratory experiences; community or field based science
- 7) effective and diverse assessments including both formative/summative authentic and traditional;
- 8) enrichment activities that involve students in applying science and go beyond the standard curriculum
- 9) strategies of planning of science curricula as well as specific strategies for the integration of other disciplines (interdisciplinary curriculum).
- 10) inclusive science education strategies including SDAIE that enhance the science curriculum for all learners.
- 11) Application of teacher designed and led research called action research with the purpose of improving practice.

Teacher Performance Expectation (TPE) Competencies:

This course is designed to help teachers seeking the Single Subject 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 is addressed in this course:
TPE 1B: Subject specific pedagogical skills

California Teacher Performance Assessment (CalTPA)

Beginning July 1, 2008 all California credential candidates must successfully complete a state-approved system of teacher performance assessment (TPA), to be embedded in the credential program of preparation. At CSUSM this assessment system is called the CalTPA or the TPA for short.

To assist your successful completion of the TPA 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.

Additionally, SOE classes use common pedagogical language, lesson plans (lesson designs), and unit plans (unit designs) in order to support and ensure your success on the TPA and more importantly in your credential program.

The CalTPA Candidate Handbook, TPA seminar schedule, and other TPA support materials can be found on the SOE website provided at the website provided:
<http://www.csusm.edu/education/CalTPA/ProgramMaterialsTPA.html>

Required Texts:

Science Instruction in the Middle and High School (Chiappetta and Koballa) (2009 Seventh Edition) available for purchase @ Amazon etc.

Use of Discrepant Events for K-12 Science Teachers (Aztec Press /University Bookstore), (Keating) available in bookstore only

California Frameworks in Science (State Dept of Education) under <http://www.cde.ca.gov/re/pn/fd/documents/science-framework-pt1.pdf> (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)/Flinn Scientific Safety Manual (both available as free downloads)

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 4:30-7:30

Authorization to Teach English Learners

This credential program has been specifically designed to prepare teachers for the diversity of languages often encountered in California public school classrooms. The authorization to teach English learners is met through the infusion of content and experiences within the credential program, as well as additional coursework. Students successfully completing this program receive a credential with authorization to teach English learners.

(Approved by CCTC in SB 2042 Program Standards, August 02)

School of Education Attendance Policy

Due to the dynamic and interactive nature of courses in the School of Education, all students are expected to attend all classes and participate actively. At a minimum, students must attend more than 80% of class time, or s/he may not receive a passing grade for the course at the discretion of the instructor. Should the student have extenuating circumstances, s/he should contact the instructor as soon as possible.

(Adopted by the COE Governance Community, December, 1997).

Both attendance and punctuality 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 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.

Students with Disabilities Requiring Reasonable Accommodations

Students with disabilities who require reasonable accommodations must be approved for services by providing appropriate and recent documentation to the Office of Disable 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. Students authorized by DSS to receive reasonable accommodations should meet with their instructor during office hours or, in order to ensure confidentiality, in a more private setting.

All University Writing Requirement: A minimum of 2500 words of writing assignments per semester are required. This will be fulfilled through a variety of ways in this course such as : reading logs, action research reports, field trip curriculum plans, discrepant event curriculum plans and independent study reports.

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 written work and oral presentation assignments must be original work. All ideas/materials 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 with quotation marks.

Students are responsible for honest completion of their work including examinations. There will be no 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.

Plagiarism:

As an educator, it is expected that each student 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.

Course Requirements: See Description of Assignments

Grading Standards: See grade sheet and point values of all assignments

Description of all Assignments (by number): Spring Semester Only

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 (6 points each chapter) Each chapter is assigned a value of six points that includes your response to the prompt and the discussion of this response in class.

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

Assignment 4 (Internet Sites) (5pts);

Assignment 5 (Technology tool/software) (5pts)

Spirit of the Assignments: individually explore Internet and technology tools; rate them and provide feedback to classmates regarding their potential use. Send the links to our Science Methods Wiki Site.

For assignment #4 explore in detail at least one Internet site that is a valuable for teachers or students for information, simulation etc. List the URL and access it on Smart classroom projector and navigate the site and explain how you would use it in your classroom.

For assignment #5 explain or demonstrate a tool, or software program or some other technology application that you have used or know how to use that would be valuable for a science teacher.

Assignment 7: Applying Action Research to a Science Lab (SDAIE) modification (35 pts) Spring Semester

Spirit of the Assignment: Use an existing science lab or activity that you will use in CP 2 and rewrite it to be more appropriate particularly for second language learners (use SDAIE techniques as discussed in class and in Ch 12 text). Evaluate using the action research model by comparing outcomes of experimental lab (SDAIE) with control (original lab or activity) that you teach in CP 2.

Specifics of the assignment: The assignments consists of four parts in which you will 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 (5pts); 2) List of changes/ adaptations you made (5pts); 3) Design an action research proposal using the design and previous examples explained in class (see syllabus). This will be presented prior to implementation in class for input from classmates and instructor (5pts). 4) Present the

findings 20 pts (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 examples of potential data tools for applying the action research and 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.

Assignment #10: Enrichment and Extracurricular Activities in Science Teaching (20 pts X 2 = 40 pts.)

Spirit of the Assignment: Students will research, overview and discuss some of the major extracurricular activities used in Science such as Science Research Projects (Science Fair/ Pure Science), Odyssey of the Mind (Problem Solving), Science Olympiad and Invention Convention (Applied Science). Two of these models will be applied by simulating the actual process used by teachers. The process includes the following: 1) Students will be assigned teams and specific problems for Odyssey of the Mind (Long Term Problem, Spontaneous Problem and Style) and the Invention Convention. 2) Using the processes recommended and timelines (and examples reviewed) teams will follow the processes and enter their formative tasks on Google Docs (instructor will provide ongoing feedback and evaluation on Google Docs for each team; 3) Teams will present their final solution to each project and be evaluated by the rubric (see syllabus) and compared to the other teams.

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) Independent Study Class

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 Reuben Fleet Science Museum and SD Natural History Museum (20 pts)

Spirit of the assignment: by attending this field trip students will understand: 1) general procedures for planning and implementing a field trip at a formal site in science; 2) how to access and use resources provided by a site prior to going; 3) Pre, during and post

lesson plans using both a) prepared curricular materials at a field site; b) teacher developed and implemented curricular materials.

Assignment #14 Researching a current issue or topic in science and presenting a mini-lecture on that topic utilizing multiple strategies (20 pts). Spring Semester

The spirit of the assignment: Research a current issue or topic (outside the traditional science textbook) that could be used in a class you are scheduled to teach in CP2. The instructor will model a mini-lecture prior to student presentations and a rubric will be developed through a class discussion based on information from Ch 11. During this 15-minute mini-lecture you will practice applying some of the pedagogical strategies from Chapter 11 in the course text (Using Lectures in Science). The class audience and instructor will discuss your presentation and evaluate/provide feedback using the rubric for a Science Mini-Lesson (see syllabus).

Assignment #15 Issues in Science Student Teaching (Case Study 2): (Preliminary discussions (3 @5pts each and final written presentation= 15+20=35 pts)

The spirit of the assignment: This is a form of action research and like the other model used this semester (and the experience of Case Study 1 from Fall semester) will prepare the teacher with a strategy to formally address problems and issues they will face during their careers. The assignment consists of preliminarily sharing issues/ problems/action plans and solutions to various issues that occur during CP2 related to curriculum, teaching strategies and classroom management. The final report will summarize what findings and implications were suggested from the outcomes. The Case Study Model used will be discussed in class and used as an approach to address real solutions understand subsequent outcomes from the action plans.

Spring Semester:

Assignments due for Class #1 January 30

- 1) Reading log Ch 11 (Lecture): **Prompt: What are the pro's and con's of using lectures (expository teaching)? Which of the ideas in this chapter will I incorporate in my 15-minute lecture to be given in class?**
- 2) **Have 3-5 minute edited video of DE from Fall Semester for discussion**

#1 January 30 (Monday) Theme: The lecture as a teaching strategy in Science

- Review syllabus for second semester
- Construct a graphic organizer for semester 2
- Discussion of prompt from Ch11
- *Discussion of assignment regarding ratings of technology tools/software #5 and internet resources #4 (see description in syllabus)
- Present DE edited video

- Keating mini-lecture #1 Model lecture that integrates some of the ideas from Ch 11 “Factors that affect the success of Navajo Students in High School Science”

Next time:

- Prepare a mini lecture as part of a small unit on some current topic/issue in Science for one of the classes this semester (create schedule) Assignment #14
- Presentation/Handout of ratings of technology tools/software #5 and internet resources #4 (Demo one of the top ideas for each)
- Read and address prompt for Ch 12 Science Technology and Society (Integrating Science as a Discipline) and Ch 15 Use of Technology in Science: **Based on the content of each of these two chapters: Discuss the range of technology you would use or have used (or seen) in the science classroom (Elaborate and Be specific)**

#2 February 6 (Monday) Theme: Technology resources in Science

- Presentation of lesson on current topic in science using mini-lecture approach (15 minute max) (aligned with Ch 11 Lecture Strategy) Assignment #14 (2-3 presentations)
- Discussion of Best Practices in Science Teaching from both technology tools/software and Internet Resources for:
 - #4 explore in detail at least one Internet sites that is a valuable for teachers or students for information, simulation etc. List the URL and access it on Smart classroom projector and navigate the site explaining how you would use it as a resource.
 - #5 explain or demonstrate a tool, or software or some other technology application that you have used or know how to use that would be valuable for a science teacher.
- Discussion of prompt responses from Ch 12 and Ch 15 on technology

Review Assignments for Next class:

1) Reading prompt to respond for Ch 8 (Teaching for Diversity): **As a result of reading this: What are some specific strategies (teacher, student and curricular) you would (or have) use to adapt learning for second language learners in your science classroom (elaborate and be specific)?**

#3/#4 February 25 Saturday 9-3 Themes: SDAIE instruction in Science and Extracurriculum Strategies in Science

- Discussion of reading response to prompt from Ch 8 Diversity in Science Instruction
- Keating mini-lecture #2: “ Successful SDAIE strategies with Navajo Students: Findings from dissertation study”
- Student Mini-Lectures (4-5 presentations) with critique/evaluation
- Review of Inquiry based topics (DE/Open ended experiments) with an introduction to curricular and extracurricular science projects: Odyssey of the Mind/ Invention Convention/Toys in Space as additional models of Inquiry based learning (some modeling and practice in implementing these)

- Assign teams for presentation of “Invention Convention” and “OM” Bridging the Gap (see Model to Solve Problems time line and Invention Convention time lines). Use Google docs to share ideas (formative tasks) with colleagues and instructor. Assignment #10 Presentation due April 9
- Presentation of any carry-over technology assignments
- Discuss SDAIE action research project specifics below

Review assignments for next class:

- 1) Using a Science lab that you are scheduled to use in CP2 adapt it to apply some of the SDAIE strategies (teacher, student or curricular) you have discussed. Be prepared to: 1) share these labs (the control (traditional) and experimental (SDAIE) using a visual (overhead/PowerPoint): 2) Use the action research proposal form (see syllabus addendum) to discuss your research design on addressing the question: Effectiveness of SDAIE techniques in science lab settings (**See Assignment # 7 description in the syllabus**).
- Your **final report** research report will due on _____ and will include: 1) copies of both experimental and control lab directions; 2) Complete Action Research Report including findings from the study.
- Reading log response from Chapter 13 Laboratory and Field work: **Prompt (Based on the reading): Discuss a range of ways that you have or will use both laboratory and field experiences in your science classroom? More specifically how have you or will you incorporate open-ended elements (inductive) strategies into lab or field exercises?**
- Read section on Authentic/Alternative Assessments from text Ch 4 (pp 55-58): **Prompt: Which one these alternative assessments have you seen or would you consider using this semester in your science teaching Why don't you see more of this type of assessment and how might you overcome these challenges?**
- Issues in Science Student teaching presentation of question or problem that will be addressed in CP 2 (development of Case Study 2 Issue(s) (#15)

#5 March 19 (Monday) Theme: Using Action Research as a Science Teacher/SDAIE

- Present preliminary experimental (SDAIE lab) and control science lab instruments and Action Research Proposal that will be used in conjunction with Assignment #7: Effectiveness of SDAIE techniques in science lab settings
- Mini-Lecture presentations (2)
- Issues in Science Student teaching CP2 statement of question or problem that will be addressed (development of Case Study 2 Issue(s) (#15). (**First preliminary discussion**)
- Discussion of reading prompts from Ch 13 Laboratory and Field Work
- Discussion of prompts for Ch 4 pp 55-58 on Authentic Assessment

Review assignments for next class

- 1) Review web pages for Reuben Fleet and Natural History Museum (agenda for field trip)
- 2) Presentation of final group solutions to OM and Invention Convention

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#6 April 9 (Monday) Theme:

- **Second Preliminary discussion** on progress of Issues in Science Student teaching CP2 (#15): What are your action plans/progress so far? Questions/concerns?
Final Report due: _____
- Keating mini-lecture #3: “Teaching to the Second Tier: Why are we losing so many good science teachers?”
- Mini-Lecture presentations (final 2)
- Presentation of final group solutions to OM and Invention Convention

Review assignments due for last class (April 23):

- Complete Independent Study/Open date assignment (#12) and send report electronically to all
- Continue to gather data for Issues in Science Teaching (third preliminary report due)
Final report due May 16th
- Review web pages for Reuben Fleet and Natural History Museum (agenda for field trip)

#7 and #8 April 21 Saturday (9-3 counts as two classes): Field Trip to a Formal Museum site (Reuben Fleet/ Natural History): Theme: Use of Community Resources in the Curriculum (Assignment #13)

- Educational Resources at both museums (based on handouts/WebPages)
- In subject matter teams: Design a pre/ during/post lesson that includes specific logistics and assessments for one or more of the demonstrations at Reuben Fleet (final team written design made available to all via email)
- In subject matter teams: Design a pre/ during/post lesson with specific logistics and assessments for one or more of the demonstrations at the Natural History Museum (final written design made available to all via email)
- After viewing one of the available movies at the site: How would connect it to the curriculum and how would you make students accountable for the material seen in movie? (Written response made available via email)

Review assignments due for final class:

- Book report due in class #11
- Continue to gather data for Issues in Science Teaching (third preliminary report due)
Final report due May _____

#9 April 23 (Monday) Theme: Using the Case Study Model of Action Research to assist in Solving Problems in Science Teaching

- **Third Preliminary Report:** Issues in Science Student Teaching CP2. What are your action plans/progress so far? Findings? Questions/concerns? (Final due on May 14th)
- Book report
- Final evaluation of course: Review/Assessment/redesign of Graphic Organizer
- Instructor evaluations

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.)

- 1) Attendance/participation (5 pt. per class) (50 pts.)
- 2) Science Methods Text Readings/Prompts (6 Chapters @ 6pts each) (36 pts)
- 4) Presentation on technology tools for best practices in Science (5 pts)
- 5) Presentation on Science Internet sites (5 pts)
- 7) Science lab SDAIE modification and action research findings (25 pts)
- 10) Enrichment/ Extracurricular Activities in Science Teaching (OM/Inv) (40 pts)
- 11) Book Report on high interest science book (5 pts.)
- 12) Open ended science related event both semesters (independent study) (10 pts)
- 13) Strategies for implementing field trips at the high school level: Reuben Fleet/National History Museum (20 pts).
- 14) Presenting a mini-lecture on a current topic in science (20 pts)
- 15) Case Study2: Issues in student teaching CP2 =(5+5+5 +20)=(35 pts)

Optional/Extra credit: (maximum 10 pts)

- 1) Directorship (5 pts.)
- 2) Attendance at a Science Conference: SDSEA or CSTA or NSTA or other Conference (5 pts. one day)

Addendum A (Spring Grade Sheet)

EDSS 545 B Spring Semester Grade Sheet

Name

Assignment Number/Name

#1 Attendance (5pts each class) indicate nights absent by date

(50 pts possible)

#2 Science text reading logs 6 readings X (6pts each) indicate scores on each chapter assigned below) (Ch 4_Ch8_Ch11_Ch12_Ch15_Ch13_) (36 Pts)

#4 Presentation of internet site (5pts)

#5 Presentation of Technology tools/software (5pts)

#7 Action Research Study on Effectiveness of SDAIE vs Traditional Lab Experiences (10 prelim + 15 final= (25 pts)

Preliminary Proposals

Final Written and oral report of findings

#10 Enrichment and Extracurricular Activities in Science Teaching (OM/INV) 20+20= 40 pts.

#11 Book Report on high interest science book (5 pts)

12 Independent Study at formal or informal science event (Report) (10 Pts)

#13 Attendance and Reports on Science Field Trip (20 pts)

Reuben Fleet

Natural History

Movie

#14 Mini-Lecture as introduction to science topic (20 pts)

#15 Issues in Science Teaching (Case Study Approach) 5+5+5 (prelim)+20(final)=(35 pts)

Total Possible= 251 pt

Points Earned=

Average/Grade=

Addendum B (Action Research Design Proposal/Final Report: Use with Assignment #10)

Action Research Project Design Proposal Plan

Purpose:

- 1) To apply the principles of action research in a teacher directed and designed project.
- 2) To model the concept of the teacher as a researcher.

Design Plan

Problem: (specifically what question(s) are you posing)

Information: (what are potential sources of background information related to your question(s). This literature review of your topic can assist you in more formally organizing both your questions and as a basis for formulating your research design. Although it is not part formally a part of this assignment to include this you have done a lot of informal background reading and discussion to inform you related to this topic.

Hypothesis: (based on background information and what do you predict will be the answer to the question). This may be stated in the form of a null hypothesis (ex. there will be no difference between method A and B in learning science concepts) or research question format (ex. students will learn science concepts better when using method A). Remember it is not so important that the data supports or refutes the hypothesis but rather that it (data) accurately justifies your conclusions.

Experimental Design: This section should include an overview describing **the nature of the type of research study** i.e. quantitative, qualitative (or both) as well as the general procedures which will guide you such as: any materials, instruments and techniques utilized **to gather data**; the **subjects** which will be the focus of the study; **time frame** for conducting the study; and methods used to **analyze data**. Remember to explain how you will attempt to control the critical variable of researcher effect with **triangulation techniques** (since in many cases you will be both the teacher and the researcher).

Data/Results: How will the data be represented? For example, will a journal be used, data tables constructed and or graphs produced? If statistical analysis, please specify.

Conclusions: Is the analysis of your data support , refute (or yield inconclusive results)related to your hypothesis? What inferences could you draw from the conclusions? What additional questions and research might your results suggest? What potential implications might your findings suggest (for your classroom or for learning and teaching in general)?

Addendum C (Case Study Preliminary and Final Report)

Case Study Considerations for Assignment #15 Issues in CP 2

A case study is a formal strategy to collaboratively problem solve some issue in education (in this case science education). Some generalized steps should include at a minimum at least the following preliminary steps leading to a final report:

- 1) **Identify a problem** which is inhibiting your ability to teach or the students' ability to learn. *It may take many forms such as: infrastructure: I room is too small to have laboratory type exercises; management: one of my students will not do any homework; teaching materials: I have no lab manuals and little materials; teaching strategies: I do not know how to deal academically with such a wide range of abilities in my class. ETC.*
- 2) **Brainstorm possible solutions** based on general knowledge from classes, readings, master teachers and prior experiences. After you have discussed the issue with your partner and instructor get feedback and suggestions from them. *Ex. From infrastructure problem: swap rooms with another science teacher one day a week when they are not using the lab. This should be coordinated with the principal and based on state mandated requirements for safety in science laboratories*
- 3) **Propose an action plan with specific actions and a timeline**
For three weeks with plenty of warning to the students change rooms to use the lab. Identify additional problems this may create and propose changes.
- 4) **Gather data from observations and responses to your plan**
Students took an extra five minutes to get to this lab so I said if they were on time this would result in a bonus of 5 pts on their lab report for at least the first three weeks.
- 5) **Final Report should include aspects of 1-4 in addition to the outcomes and implications** from the action plan: What were the successes and the challenges to the plan? What would you do next to improve on it?

I would request an adequate lab space from the principal or whoever schedules a year prior. I would make a recommendation on which room might be a good fit for my curriculum and point out the state requirement for adequate space and safety for laboratory based science classes.