California State University San Marcos
College of Education
EDST 610: Current Issues and Research in Science Education
Tuesdays 4:30-9:00
San Juan Capistrano Cohort
Spring 2006

General Information:

Instructor:
Joseph Keating, Ph.D.
Professor of Science Education,
Office Hours: UH 309 or by appt.
Phone: 760-750 4321
Email: jkeating@csusm.edu
Fax: 760-7503237

College of Education Mission Statement
The mission of the College 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 ongoing service. Our practices demonstrate a commitment to student-centered education, diversity, collaboration, professionalism, and shared governance.

Course Description:

The description and the course objectives/ schedule may be subject to adjustment, additions or subtraction based on student and teacher input before, during and after completion of this course. The purpose of the course should serve multiple purposes all related to the understanding and the challenges of teaching science in today's schools. **Since this course will be taught in 8 weeks some of the required course contact hours will be completed on-line through WebCT and email and via independent study. Expectations are that approximately 1.5 hours per week will required/ assigned to these formats.**

The first purpose is to familiarize the student with the major issues in science education at the state, national and international levels and the corresponding research as evidenced through readings, discussion, case study development and mini-lectures.

A second purpose is to use this focus, to personalize the inquiry by proposing and implementing a more formal inquiry/investigation in one's own classroom or school. The model that will be taught and used for this is called action research. It could be the basis for the beginning of a thesis or at the very least an experience to assist in thesis project. This experience will have additional benefits in that it will involve multiple forms of technology (and math) to design, implement, analyze, present and disseminate findings. Many of these processes also serve as models for the National Board requirements and are also examples of applications of National Technology Standards for Teachers. These include for example, three aspects of the National Board requirements that will be integrated into the project: 1) applying action research to the analysis of a classroom issue or problem; 2) the use of various

forms of technology to document one's teaching/learning process and 3) dissemination of these findings to school personnel and (or) parents. In addition, the National Technology standards for teachers are woven throughout the project in that (Standards I-VI p.306) ' will improve curriculum, teaching and learning, assessment and evaluation, and productivity and professional practice' by potentially incorporating knowledge and application of word processing, statistical software programs, databases, Internet web searches, scanning, use and editing of digital film and multimedia.

A third purpose of the course is to model and observe others demonstrating the use of one of the dominant elements in science teaching (the Inquiry Model) by sharing and critiquing inquiry-based lessons from other teacher participants.

Required Texts:

1. Cases in Middle and Secondary Science Education: The Promise and Dilemmas (2004). Second Edition. Koballa and Tippins. Pearson Merrill Prentice Hall. ISBN #0-13-112798-5.
2.National Science Education Standards. Available: http://www.nap.edu/catalog/4962.html

Supplemental: (selected parts to be provided by the instructor or in some cases downloaded)
1)"Research within Reach: Science Education—A Research-Guided Response to the Concerns of Educators" (1995) Edited by David Holdzkom and Pamela Lutz. NSTA.
2)" What We Know About How People Learn"(2002) California Journal of Science Education. Volume II, Issue 2. CSTA.
3) National Educational Technology Standards for Teachers. (2002). International Society for Technology in Education Press. ISBN 1-56484-173-1
4) "Classroom Instruction that Works—Research Based Strategies for Increasing Student Achievement" (2001) McREL Labs: Robert Marzano, Debra Pickering and Jane Pollock. ASCD.
5) "Scoring Rubrics In the Classroom—Using Performance Criteria for Assessing and Improving Student Performance" (2001). Edited by Judith Arter and Jay McTighe. Corwin Press.
6) "How The Brain Learns" (2001) David Sousa. Corwin Press.
7) "Issues in Science Education" (1997) Edited by Jack Rhoton and Patricia Bowers. NSTA Publications. ISBN 0-87355-137-0
8) "Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide"USDE Institute of Education Sciences December 2003 (download)
9) "They're not dumb…they are different…stalking the second tier"(1992). Sheila Tobias. Research Corporation. Tucson, Az. (selections to be provided)
10) "Lost Discoveries. The Ancient Roots of Modern Science" (2002) by Dick Teresi. Simon and Schuster. ISBN 0-684-83718-8
11) The Republican War on Science (2005). Mooney. Basic Books.

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)

College of Education Attendance Policy

Due to the dynamic and interactive nature of courses in the College 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. Since this course uses one day to cover two classes (i.e. 8 days in all = 16 classes). Individual instructors may adopt more stringent attendance requirements. Should the student have extenuating circumstances, s/he should contact the instructor as soon as possible. *(Adopted by the COE Governance Community, December, 1997).*

Students with Disabilities Requiring Reasonable Accommodations

Students 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 5205, 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.

Course Objectives:

Upon completion of this course the student will be able to demonstrate knowledge, understanding, appreciation and (or) practical skills for applying.....

1) Knowledge of the major issues and research findings in science education at the state, national and international level

2) All elements of proposing and implementing an action research design as an inquiry related model to evaluate one's teaching practice (and as related directly or indirectly to one of the major issues in science or math education).

3) A variety of technological skills incorporated into the design, implementation, analysis and presentation of the action research project.

4) Effective means of disseminating one's research information to school personnel and parents and to the general public through presentations and (or) publications.

5) The inquiry, constructivist problem solving model of teaching through a hands-on, interactive model strategy.

Course Schedule

Session Tentative Topic Readings and Assignments Due

#1-#2 January 17th

- Introductions/ Overview of Syllabus/ Assignments/ Science Teaching Issues (schedule developed for discrepant events, action research proposals, case studies reading group assignments)
- #1 Mini-lecture/Discussion: Presentation of strategies to use in an Inquiry based teaching model: Discrepant Event (Happy and Unhappy Balls) (Keating)
- #2 Mini Lecture/Discussion "Factors That Affect the Success of Navajo Students in Science….Implications for diverse students" (Keating dissertation)
- Action Research Model discussed with examples (Keating)

Next time: 1) read grade appropriate TIMSS study from (reading log prompt): What are the strengths and weaknesses of American Science Education. http://timss.bc.edu/TIMSS1/Items.html
2) Keating dissertation summary (WebCT) (reading log)
3) McREL Lab Findings (WebCT) of most effective science teacher strategies (Keating) (reading log Prompt): Which do you use and how?
4) Cases: Chapter 1 Use as a research tool. (overview) and Ch2 Reading logs (Group One Analysis)

#3-4 January 24th

- #3 Mini Lecture/Discussion: McREL Lab Findings of most effective science teacher strategies and how class participants are using them (Keating)
- #4 Mini-Lecture/Discussions of Readings: TIMSS Study Summary discussion (download)
- Questions on Navajo Science Education Study
- Student Presentation and audience evaluation of Collaborative Inquiry model (2pairs)
- Cases Discussion (Ch 1-2)

Next time: 1) Readings: Handout on teacher affect (Teacher dispositions) on WebCT: Reading log Prompt: Using the given rating scale how would you rate yourself (with justification for each area)?
2) New York Times web archived articles on evolution vs. intelligent design (reading log prompt): What are the arguments for and against including ID in a science class?
3) Cases: Chapter 3-4 (Reading logs) Group Two Analysis)

#5-6 January 31st

- #5 Mini-lecture: "Research findings on the importance of teacher affect (teacher dispositions) on effective teaching" (Keating). In class discussion of self evaluation/action plan for teacher dispositions (follow up during last class session)

- #6 Mini-Lecture/Discussion: Controversial Issues in Science Education: Evolution vs. Creationism (or ID)"
- Student Presentation and audience evaluation of Collaborative Inquiry model (2pairs)
- Graduate student presentation of Action Research/thesis process; Vicki Roberts
- Cases Discussion (Ch 3-4)

Next time: 1) Action Research Proposals and presentations due
2) Cases: Chapter 5-6 (Reading logs) Group Three Analysis)

#7-8 February 7th

- Action Research Proposal Presentations (5 –7 minutes each)
- Student Presentation of Collaborative Inquiry model (2 pairs)
- Cases Discussion (Ch 5-6)

Next time: 1) Handout on WebCT: Selections from 'Teaching the Second Tier' (Tobias) (reading log prompt): Why do so few students complete a degree in science or math (or teaching science or math) and what can we do about it as teachers of science or math?
2) Handout on WebCT: Selections from: " Differentiated instruction" (reading log prompt): What are some of the elements discussed that you have used (successes and challenges)?
3) Cases: Chapter 7-8 (Reading logs) Group Four Analysis)

#9-10 February 14th

- #7 Mini-Lecture/discussion: "They're not dumb…Teaching the Second Tier" (Tobias)
- Student Presentation of Collaborative Inquiry model (2 pairs)
- #8 Mini-Lecture/discussion "Research findings on differentiated instruction in Science" (Keating)
- Cases Discussion: Chapter 7-8

Next time: 1) Handout on WebCT: selections from "Importance of multiple forms of Assessment in Science Education" (reading log prompt: Which of these do you use (successes and challenges?)
2) Cases: Chapter 9-10 (Reading logs) Group Five Analysis)

#11-12 February 21st

- Issues in Action Research Design Projects (short overview of progress)
- Student Presentation and audience evaluation of Collaborative Inquiry model (3 pairs)
- #9 Mini Lecture/discussion: "Importance of Pre, Formative and Summative Assessment in Science and Math Education"
- Cases Discussion: Chapter 9-10

Next time: 1) Handout on WebCT: selections from " Republican War on Science" (Reading prompt; What are some of the scientific issues that may have been compromised and as a teacher how do we get our students to look at science from a political perspective?

2) Cases: Chapter 11-12 (Reading logs) Group Six Analysis)

#13-14 February 28th

- #10 Mini Lecture/discussion: "Politics of Science and Science Education
- #11 Mini Lecture/discussion: "Enrichment in Science Programs K-12"
- Student Presentation and audience evaluation of Collaborative Inquiry model (3 pairs)
- Cases Discussion: Chapter 11-12

Next time:

1) Action Research findings presentation (5-7 PowerPoint or other visual)
2) Written report on action research findings that includes 250 word "manuscript" abstract that could be used for dissemination or as a basis to solicit possible publication
3) Paragraph explaining "plan for dissemination" to other interested parties

 # 15-16 May 9th

Presentation of Action Research (see all required parts above)
Instructor Evaluations/ Summative Evaluation Process/Course Overview

Graduate level norms and expectations of class/ assignments:

- Expectations are that all assignments will be professionally done (i.e. typed and at the highest quality level representative of graduate work)
- Citations should always be used when utilizing information from another source as well as quotations if direct quotes are used
- Punctuality and attendance and participation are essential and missed assignments and classes will be excused only for highly unusual circumstances. **Any assignments that could be made up from missed days (not all could since they are group and interactive) will only count a maximum of ½ their value since discussion/reflection of these assignments in class is an essential part of the process. Two missed classes will lower student grade by one and three may result in a dropped from the class.**
- We know you have many obligations and tasks as a full time teacher but active participation in class does not include grading student papers, searching computer sites or answering emails or any other non-course related functions. You would not want your own students doing this and should model appropriate behavior as a student yourself. If you do not have time to devote to the MA program and its class time and teach full time then you should not attempt it at this time.

Synopsis of each assignment (Spirit of the Assignment):

#1 Reflective Reading logs (and or prompts) of all non-Cases assigned readings:
These are not collected but should be available for others to read and provide input. In order for one to participate in discussions (whole and small group), expectations are that they would be completed in full with thoughtfulness and application to the specific prompt in the syllabus. A class "buddy" will also provide some feedback/input for each reading log. The following format is a possible suggestion of how this might be done (Note: the "Cases" reading logs will be done on WebCT and have a specific format that will be discussed in class and are summarized in #2 below):

- Short summary of the main ideas
- List some questions you would like to discuss with your group
- Make some connections with something that has happened in your teaching and/or learning experience.
- Create a visual of what your favorite part of the reading, what you learned and share it

#2 Case Studies Reading Logs (to be submitted in WebCT)
A small team of 3-4 class participants will be assigned one or more chapters to analyze and summarize and submit a report/discussion in class that is based on input from all students reading logs WebCT**. Note: The online time spent writing, submitting and or analyzing these is in substitution of required in-class hours (approximately 1.5 hours per class meeting.**

#3 Discrepant Event/ Inquiry Presentation: The spirit of this assignment is for the class to observe a variety of examples of teaching using the inquiry approach and have an opportunity to critique it. Each pair of students will prepare an inquiry-based lesson appropriate for K-12 science and (or) math (approximately 15-20 maximum) (20 points maximum). A handout lesson plan should be available at the conclusion of the presentation that includes as a minimum: standards addressed, objectives, materials and resources, procedures, assessments and explanation (10 points). Drawings may help. Presentations (20 points maximum) will be evaluated by the instructor and peers using the following rubric:
1) Appropriateness of materials (0-5)
2) Questioning Techniques (0-5) Non-judgmental, Science process skills, Constructivist, Closure
3) Involvement/Engagement of audience (0-5)
4) Teacher Content Knowledge (0-5)
5) Overall comments and scoring (20/20 possible)

#4 and #5 Action Research Proposal and Final written and oral presentation and Abstract (see #6 below)

The spirit of the assignment is for each student to have the opportunity to develop and implement a teacher-directed research project (action research) that addresses some

question related to ones own practice. This should assist the student as a pilot or at the least a practice exercise for doing the MA thesis. The final outcomes of this assignment includes: 1) written and 2) oral report of the findings, (may include an edited videotape in support of those findings); 3) a proposal for the dissemination of the findings via a presentation to a school and or parent group. Connected to this assignment is the 250 word manuscript "abstract" of study that could be used for dissemination or consideration for publication (see #6 below). For specifics of format see Action Research Proposal Form, which will be a handout in class that includes: statement of the problem (question(s), background of the problem, hypothesis, experimental design (triangulation), data collection techniques (analysis), conclusions and implications.

#6 Abstract/ Manuscript of Action Research Project

Each student will complete the action research project described above that demonstrates his/her understanding of using teacher directed research. This project is an opportunity to exercise creativity and individual preference in selecting what is to be specifically done while giving the student skills for sharing their expertise with other teachers through professional publications. As part of the Action Research project will you will write a short manuscript/abstract (250 words) that may be suitable for dissemination as a summary of your research and findings and (or) for submission for publication in one of the typical action research or science teaching journals such as (*Science & Children, Science Scope or The Science Teacher)*. This would serve as a template for submission and of course the exact manuscript submission guidelines for the journal chosen would have to be followed in order to submit an actual proposal.

#7 Teacher Dispositions (affective behavior)

The spirit of the assignment is for each student to self evaluate his (her) own teaching affect and to write up an action plan for improvement in those areas deemed necessary (this will be done in class with a partner). During the final class a discussion of progress towards this goal will be made with instructors input. Expectations are that those positive behaviors (dispositions) will be modeled during the class with both colleagues and instructors.

#8 Final or Summative Student Assessment of course learning

A final exam will model an authentic and alternative way to assess individual student learning in a summative way that provides a mechanism for closure and review of course understanding. This will be done "in class" during final meeting in May.

Summary List and Value of each Assignment:

1) Reflections/comments on each non-cases reading (logs) or prompt assignment 2pts@10=20pts
2) WebCT Reading logs and group leader analysis/summary 2pts@ 12 =24pts
3) Science Discrepant Event/Inquiry Presentation and Lesson Plan (20+ 10)= 30pts
4) Action Research Proposal and presentation=20 pts
5) Action Research Final Presentation and written report = (20 +20)= 40pts
6) Manuscript of action research project= 10 pts

7) Attendance and Participation in discussion/evaluations 3pts@16=48pts
8) Teacher Dispositions (self and instructor evaluations) = 10 pts

Total = 202 pts. Possible

A = 90-100 % (A or A-) range
B = 80-89 (B+, B or B-) range
C = 70-79 (C+, C or C-) range note: no credit repeat course for less than C+
D = 60-69 repeat course
F = < 60 repeat course