EDST 610: Current Issues and Research in Science (Three Credits)—Spring 2004

Instructor: Joseph Keating, Ph.D. Associate Professor of Science Education, Single Subject Program Co-Coordinator in the College of Education
Class Schedule: All classes meet Wednesday from and 5:30-8:15
Room: UH 460
Office Hours: UH 309 by appt.
Phone: 760-7504321
email: jkeating@csusm.edu
fax: 760-7503237

California State University San Marcos
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.

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. 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 a 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. 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 edited digital video and still photography to document some aspect of 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 including a minimum knowledge and application of word processing, statistical software programs, databases, Internet web searches, scanning, using and editing digital film and multimedia presentations. A third purpose of the course is to

model and observe others demonstrating the use of the dominant model in science (the Inquiry Model) by sharing and critiquing inquiry-based lessons from other teacher participants. The fourth purpose is to investigate the nature and source of science and math knowledge from a more multicultural and universalist perspective in order to expand one's knowledge and understanding of origins of ideas. By exploring these ideas it is hoped that one's own teaching will be more reflective of this type of exploration with a more universal process than is widely presented in the media and texts used today.

Required Texts:
"Lost Discoveries. The Ancient Roots of Modern Science" (2002) by Dick Teresi. Simon and Schuster. ISBN 0-684-83718-8
"Cases in Middle and Secondary Science Education" by Koballa and Tippins.. Second Edition. Pearson Merrill Prentice Hall ISBN O-13-112798-5

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 (articles will be photocopied by instructor)
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)

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 to one's teaching practice (and as related directly or indirectly to one of the major issues in science or math education).
3) a more multicultural, universalist approach to the understanding of science and math investigation and knowledge

4) a variety of technological skills to the design, implementation, analysis and presentation of the action research project as well as in other aspects of the course.
5) effective means of disseminating one's research information to school personnel and parents.
6) the inquiry, constructivist problem solving model of teaching through a hands-on, interactive presentation.

Course Schedule(and schedule of assigned readings and other assignments):

Session Tentative Topic Readings and Assignments Due

#1 January 28th

Introduction/ Overview of Syllabus/ Assignments/ Teaching Issues (schedule developed for discrepant events, facilitation of Discoveries and case studies reading groups)

**Next time:** 1) read grade appropriate TIMMS study from: http://timss.bc.edu/TIMSS1/Items.html

2) Ch 1 Cases: Cases as a Research Tool in science education

#2 February 4th

Readings: Ch 1 Cases: (see reading logs assignment #1)
Action Research Model discussed with examples (Keating)
Readings: TIMMS Study Summary discussion (download): Int. overview
McREL Lab Findings of most effective teacher strategies (Keating)

**Next time:** Readings: Cases Ch 2: Adolescent Learners in Science
"Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide" (download)

#3 February 11th Discussion Cases Ch 2: Adolescent Learners in Science

#1 Mini-lecture:" Research findings on the importance of teacher affect (teacher dispositions) on effective teaching" (Keating)
#2 Mini-lecture: Presentation of an example of an Inquiry based teaching model: Discrepant Event (The Mystery Box) (Keating)
Discussion: "Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide

**Next time:** Action Research Proposals due

#4 February 18th

Action Research Proposal Presentations (5 –7 minutes each)

**Next time:** Cases Ch 3: Reform In Science Education

#5 February 25th Cases Ch 3: Reform In Science Education

#3 Mini-Lecture: Designing Effective Rubrics for Performance Assessments
Student Presentation of Collaborative Inquiry model (2 pairs)

**Next time**: Cases Ch 4 Planning for Science Instruction

#6 March 3rd Cases Ch 4 Planning for Science Instruction

Student Presentation of Collaborative Inquiry model (2 pairs)
#4 Mini-lecture: Where's the Money? grant writing strategies for supporting your ideas

**Next time:** Cases Ch 5 Organizing a Positive Learning Environment
Inquiry based Software programs in science (choose one to explore and report)

#7 March 10th Cases Ch 5 Organizing a Positive Learning Environment
Student Presentation of Collaborative Inquiry model (2 pairs)
Software Programs in science: report
**Next time:** Cases Ch 6 Learning in the Science Classroom

#8 March 17th Cases Ch 6 Learning in the Science Classroom
Demonstration of Collaborative Inquiry model (2 pairs)
#5"Factors That Effect Success of Navajo Students" (Keating)

**Next time:** Cases Ch 7 Learning in the Lab and Informal settings

#9 March 24th Cases Ch 7 Learning in the Lab and Informal settings
Demonstration of Collaborative Inquiry model (2 pairs)
#6 Brain Research on Learning 1: Biorhythms and Sleep Deprivation (Keating)
**Next time:** Cases Ch 8 Controversial Issues in Science Ed (note no class on March 31st Spring Break

#10 April 7th Cases: Ch 8 Controversial Issues in Science Ed
Book of the Month Meeting (Discoveries Ch 1-3)
Demonstration of Collaborative Discrepant Event (2 pairs)

**Next time: Cases:** Ch 9 Role of Technology in Science Teaching and Learning

#11 April 14th Cases: Ch 9 Role of Technology in Science Teaching and Learning
#7 Brain Research on Learning 2; Multiple Intelligences and how people best learn Science (Keating)
Demonstration of Collaborative Discrepant Event (2 pairs)
**Next time:** Cases: Ch 10-12
Presentations of Personal Cases

#12 April 21st Cases: Ch 10-12
Book of the Month Meeting (Discoveries Ch 4-6)
Presentations of Personal Cases

**Next time:** Presentations of Personal Cases

#13 April 28th Book of the Month Meeting (Discoveries Ch 7-8) (Keating)
Presentations of Personal Cases

**Next time:** Final Action Research Papers and Presentations due

#14 May 5 (Final) Presentation of Action Research and Supporting Video

**Next time:** Final Action Research Papers and Presentations due

#15 May 12th (Final) Presentation of Action Research and Supporting Video
Instructor Evaluations/ Course Overview

**Graduate level expectations of 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 is 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 1/2 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.**

**Synopsis of each assignment:**

**#1 Reading logs of all assigned readings: these are not collected but in order for one to participate in discussions, expectations are that they would be available). This is on the honor system but if it is evident that a student has not done the reading and the log he or she will be deducted appropriate points. The following format should be used unless otherwise indicated:**

- Short summary of the main idea (or problem or issue in the CASES)
- List at least three questions you would like to discuss with your group.
- Make at least three connections with something that has happened in your teaching and/or learning experience.
- Find at least four interesting concepts or passages that are new or have special meaning to you and or recommendations (especially for the CASES).
- Create a visual of what your favorite part of the reading, what you learned and share it

**#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). 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. Drawings may help. Presentations 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

**#4 and #5 Action Research Proposal and Final written and oral presentation**
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 the thesis. The final outcomes of this assignment includes: written and oral report of the findings, an edited videotape in support of those findings and dissemination of the findings (using the video) via a presentation to a school and or parent group. See Action Research Proposal Form, which will be a handout that includes: statement of the problem (question(s), background of the problem, hypothesis, experimental design (triangulation), data collection techniques (analysis), conclusions and implications. The final paper will include all to these areas in addition to a 200 word (max) abstract summarizing the study.

**#6 Discoveries in Science the** spirit of the assignment is to read each chapter of the book and analyze via the reading log model. A facilitator for each chapter will develop a "Book club of the Month Model to discuss the chapter. These could serve as models for using this strategy with one's own students. Each chapter should be limited to a 15-20 minute discussion.

**#7 Case Studies in Science Education** the spirit of the assignment is to read each chapter of the book and analyze using the reading log model as a basis. A facilitator will lead the discussion using whatever model they deem appropriate. Each chapter should be limited to a 15-20 minute discussion.

**Summary List and Value of each assignment:**
1) Reflections/comments on each reading assignment (self assessment) 1pts@13=13pts
2) Attendance and Participation in discussion/evaluations = 2pts@16=32pts
3) Science Discrepant Event/Inquiry Presentation 10pts
4) Action Research Proposal/Final Draft Part 1 ( 5+5)=10 pts
5) Action Research Presentation and Video Documentary 15 pts
6) Discussion (reading logs) of "Lost Discoveries" chapters 5 pts
7) Discussion (reading logs) of "Cases in Middle and Secondary Science Education" and presentation of open case 5 + 5= 10pts

Total = 100 pts. Possible

A = 90-100 (A or A-)
B = 80-89 (B+, B or B-)
C = 70-79 (C+, C or C-) repeat course for less than C+
D = 60-69 repeat course
F = < 60 repeat course