California State University San Marcos
College of Education
EDST 610: Current Issues and Research in Science Education
Tuesdays 5.30 - 8.15 p.m. at Alvin Dunn Elementary School
Room 48
Fall 2005

General Information:

Instructors:

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

Moses Ochanji, Ph.D.
Assistant Professor of Science Education
Office Hours: UH 313 - After class or by APT
Phone: 760 750 8546
Email: mochanji@csusm.edu
Fax: 760 750 3237

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. 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.

Required Texts:

1. Weld, J. (Ed.) (2004). *The game of science education*. Boston: Allyn & Bacon.
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) "Cases in Middle and Secondary Science Education" by Koballa and Tippins.. Second Edition. Pearson Merrill Prentice Hall ISBN O-13-112798-5
11) "Lost Discoveries. The Ancient Roots of Modern Science" (2002) by Dick Teresi. Simon and Schuster. ISBN 0-684-83718-8

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

Course Schedule

Session Tentative Topic Readings and Assignments Due

#1 August 30th

Introduction/ Overview of Syllabus/ Assignments/ Science Teaching Issues
(schedule developed for discrepant events, action research proposals, case studies reading groups)
#1 Mini-lecture: Presentation of an example of an Inquiry based teaching model: Discrepant Event (The Mystery Box) (Keating)

Next time: 1) read grade appropriate TIMSS study from (reading log): http://timss.bc.edu/TIMSS1/Items.html
2) NYT web article on teaching evolution (reading log)
3) Keating dissertation summary (sent via email) (reading log)

#2 September 6

Action Research Model discussed with examples (Keating)
#2 Mini Lecture "Factors That Affect the Success of Navajo Students in Science….Implications for diverse students" (Keating dissertation)
#3 Mini Lecture McREL Lab Findings of most effective science teacher strategies (Keating)
#4 Mini-Lecture: Controversial Issues in Science Education: Evolution vs. Creationism (or ID)"
Discussions of Readings: TIMSS Study Summary discussion (download):

Next time: Readings: Handout on teacher affect (Teacher dispositions) self evaluation

#3 September 13

#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)
Student Presentation and audience evaluation of Collaborative Inquiry model
Graduate student presentations of Action Research/thesis process

Next time: Action Research Proposals due on September 27th

#4 September 20

#6 Mini-Lecture: "History of the science education Curriculum in the US from Sputnik to today" (Ochanji)
Analyzing curriculum packages
Group Tasks assignments for The Game of Science Education Readings

Next time: Action research proposal presentation

#5 September 27th

Action Research Proposal Presentations (5 –7 minutes each)
Student Presentation of Collaborative Inquiry model

Next time: Handout: Selections from 'teaching the Second Tier' (Tobias) (reading log)
Handout: Differentiated instruction (reading log)

#6 October 4th

#7 Mini-Lecture: "Theyr'e not dumb…..Teaching the Second Tier" (Tobias)
Student Presentation of Collaborative Inquiry model (2 pairs)
#8 Mini-Lecture "Research findings on differentiated instruction in Science" (Keating)

Next time: *Read assigned Chapters from chapters 1, 2 & 3 from the Game of Science Education*

#7 October 11th

#9 Mini-Lecture: "Topical Issues in Science Education and in Our classrooms" (Ochanji)

Next time: *Read assigned Chapter from chapters 8 & 9 from the Game of Science Education*

#8 October 18th

#10 Mini-Lecture: "Teaching the Nature of Science: Is it part of our curriculum?" (Ochanji)

Next time: *Read assigned Chapter from chapters 5, 6 & 7 from the Game of Science Education*

#9 October 25th

#11 Mini-Lecture: How Children Learn: Perspectives from behavioral and cognitive psychology and classroom implications

Next time: *Read assigned Chapter 10 & 11 from the Game of Science*

#10 November 1

Developing Assessment Maps, Science kits and other resources for science teaching

Next time: *Read assigned Chapter 12 & 13 and Appendix A from the Game of Science Education*

#11 November 8th

Current Research Trends in Science Education – Guest Speaker

Next time: Video Conference with Keating

#12 November 15th

(Video Conference on 4th Floor UH)
Issues in Action Research Design Projects (short overview of progress)
Student Presentation and audience evaluation of Collaborative Inquiry model

#8 Mini Lecture: "Importance of Pre, Formative and Summative Assessment"

Next time: *No formal class meeting Action Research work time*

#13 November 22nd

Action Research Individual teams work. No whole class meeting

Next time: *Readings to be assigned; Manuscript Assignment Due*

#14 November 29th

Role of Science Fairs in K-12 classrooms
Turn in Manuscript Assignment

Next time: *Final Action Research Papers and Presentations due*
Progress of teacher dispositions based on action plan

#15 December 6 (Final)

Presentation of Action Research
Discussion of progress of teacher dispositions
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 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 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 Reflective 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 is a possible suggestion of how this might be done:

- 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.
- 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, (may include an edited videotape in support of those findings) and proposal for the dissemination of the findings 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 also include a 200 word (max) abstract summarizing the study.**

#6 Teacher Dispositions (affect)

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.

#7 Discussion Questions: *(Based on Readings fro: The Game of Science Education Text) – 10 points*

Each student will be required to submit a discussion question through WebCT for the class based on the readings of the assigned chapters from the book *The Game of Science Education*. Late submissions will not be accepted since the questions will be used to

direct the class discussions and activities. If you submit a question beyond the expected time, it will not count towards your grade for this assignment.

The question should be submitted to the WebCT class postings under the heading identified for discussion questions by NOON on the day of the class when such readings are assigned. The specific chapters assigned for each day are shown in the class schedule in the appendices to this syllabus. The discussion question should be an open-ended question that provides opportunity for discussion and calls for diverse responses. In addition it should reflect that you read the assigned readings. The dates when the questions are due are reflected in the course schedule.

#8 Manuscript Project - 50 points

Each student will complete a project that demonstrates his/her understanding of science curriculum theory, development, implementation, and evaluation. 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. The project will involve writing a short manuscript suitable for publication in one of the typical science teaching journals (*Science & Children, Science Scope or The Science Teacher)*. The exact manuscript submission guidelines for the journal chosen are to be followed in preparing the manuscript. The manuscript can be one of two types. One type would be an article that shares an original, innovative curriculum idea such as a lab or demonstration activity that exemplifies either the California Science Education Standards or National Science Education Standards. The other type would be a manuscript that is opinion- or issue-based that provides a critical commentary on a major topic in the area of science curriculum being faced by science educators. The manuscript guidelines for the three science teacher journals mentioned above will be provided in class.

Summary List and Value of each Assignment:

1) Reflections/comments on each reading assignment (self assessment) 2pts@10=20pts
2) Attendance and Participation in discussion/evaluations = 2pts@15=30pts
3) Science Discrepant Event/Inquiry Presentation 30pts
4) Action Research Proposal and progress report=20 pts
5) Action Research Final Presentation and written report = (15 +15)= 30pts
6) Teacher Dispositions (self and instructor evaluations) = 10 pts
7) Discussion Questions - 10
8) Manuscript writing – 50 points

Total = 200 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