Instructor: Jennifer Branch
Office Hours: Thursday 4:10 – 5:00 (or by appt.)
Phone: 310-525-9195
Email: jbran005@ucr.edu
Educ 4 – Looking in Classrooms: Science/Math Emphasis, Fall 2015

Course Summary: Exploring Math/Science Classrooms of the 21st Century

This course consists of 2 hours of lecture at the university and 3 hours observation and participation in secondary public school classrooms per week. Students will observe and participate in classroom instructional practices while developing critical observation and reflection skills. Students will be placed in local secondary mathematics or science classrooms. They will compare and contrast real classroom practice with published educational theory and consider the implications for students' learning. Emphasis will be on secondary students' acquisition of conceptual and procedural knowledge. Students will develop an understanding of the changes occurring in science and math education, the historical context of these changes, the implications for professional educators, and the career opportunities available to them in science and math education.

Course Objectives:

1. Through observation and direct participation in real classrooms, students gain insights into the practical considerations of daily instruction in public secondary schools.
2. A major focus will be to understand the interactions between teachers and students and how those interactions impact conceptual and/or procedural learning.
3. Through reflective consideration of their critical observations and technical readings, students form deeper understandings of the strategies which help develop conceptual understanding in science, technology, engineering and mathematics.
4. By developing a working relationship with classroom teachers, students will develop a more complete understanding of teaching science/math courses in a public secondary classroom from a teacher's perspective
5. Students will develop, teach and present a lesson study unit in a science/math related topic.

Lecture / Class Participation: The purpose of this course is to give students a survey of teaching as a profession, with an emphasis on science/math subject areas. To this end, the lecture periods will consist of instructor lectures, class discussions, small-group participation, group work and reflective writing. These activities are designed to develop a deeper understanding of how education in science/math related fields develops procedural and conceptual knowledge for students in secondary classrooms. We will place an emphasis on the reflective process of teaching, or the comparison between theory and practice, which potentially leads to evolutionary changes in classroom practice. Teaching science/math related fields in secondary classrooms as a profession in the 21st century will be our overarching theme. We will explore the theme from the perspective of current educational research and theory,

classroom practice and the perspectives of teachers and students. This is a survey course, touching on multiple perspectives. Through this process, students in this class will gain insights into the "real world" of teaching and the probable trajectories of the profession over the next decades. This experience will enhance their ability to assess teaching as a potential career in the context of actual practice.

Student Attendance Policy - GSOE takes seriously the need for students to attend and actively participate in classes; class absences and lack of participation undermine the learning process. Students who miss more than 20% of the course meetings are strongly encouraged to withdraw from the course. Instructors may also fail such students, except in the case of documented serious illness or immediate family emergency. Missing portions of classes, through persistent late arrival or early departure, can count toward the "more than 20%" of class time.

Students With Disabilities – If you have a disability, for which you need accommodation, please contact the instructor as soon as possible. Your feedback about the inclusivity of the course content and teaching methods will be appreciated and taken into consideration.

Category	Description	Weight
Fieldwork	30 hours (3 hours per week) Short Answer Responses This is a Course Requirement	25%
Reflective Journal Entries	Prompts on iLearn 200-400 word responses	15%
Written Assignments	Individual Assignments Detailed Below	20%
Class Participation	In-Class Discussions and Activities This is a Course Requirement	15%
Final Exam	Lesson Study: Creation, Implementation and Presentation of an Integrated science/math Lesson	25%

Assignments: Each assignment is due on the date given in the syllabus. Assignments should be submitted online via email unless otherwise noted. Written assignments may be journal entries, academic papers or lesson designs. Academic papers and lessons should be annotated using the most current APA guidelines. The assignments are designed to help guide you toward creating an integrated science/math lesson, which you will implement in a classroom and present for your final project. The Lesson Study written format will be presented in class.

Assignment 1: (Due Oct. 1)

Read: (Chapter 1 only) Wiggins, G., & McTighe, J. (2005). *Understanding by design*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Assignment 2: (Due Oct. 8)

Choose one standard from Common Core mathematics standards and one from NGSS. These will be the standards around which your Lesson Study will be built.

Read (Skim): How to Read NGSS (pgs 1-5)
Read (Skim): Three Dimensions of NGSS (pgs 1-2)
Read (Skim): How to read the Common Core Standards (pgs 2-8)
Read: (Chapters 1 and 4) Paulos, A. P. (2001). *Innumeracy: Mathematical illiteracy and its consequences*. New York: Hill and Wang.
Read: (Chapters 1-3 & 5) Lakoff, G., & Nunez, R. E. (2000). *Where mathematics comes from: How the embodied mind brings mathematics into being*. New York: Basic Books.

Write: Choose a common core Mathematics Standard **AND** an NGSS Science standard and write a brief paper (2-4 pages) in which you describe the reasons why you are choosing this standard and the implications for instruction based on what you have read in the reading assignments and what you have observed in classrooms. There should be a sound theoretical reason for you to link the standard you chose from Common Core Math and NGSS.

Assignment 3: (Due Oct. 15)

Read: Judson, E. (2013). Development of an Instrument to Assess and Deliberate on the Integration of Mathematics into Student-Centered Science Learning. *School Science & Mathematics, 113*(2), 56-68.
Read: Valdez, A. (2012). Assessing Mathematics Classroom Instruction: Observation of Learning Environments (OLE). *Psychology Journal, 9*(1), 35-43.
Read: (pgs 4-11, 33-34, 41-43 only) Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional Model: Origins and effectiveness. Colorado Springs: BSCS.
Read http://www.sedl.org/pubs/connectingkids/sessions/CK_Session1H1.pdf
Watch: http://www.bscs.org/bscs-5e-instructional-model

Write: Choose one of the performance objectives from NGSS and one of the Mathematical Practice Standards. These will be integrated into your lesson study. Write a 2-4 page analysis of integration as discussed in the readings. Please be sure to justify your decisions with explicit reference to the readings. Annotate your paper using APA Guidelines. Details given in class.

Assignment 4: (Due Oct. 22)

Read: (pgs. 385-391) Sadker, M., Sadker, D. M., & Zittleman, K. R. (2008). *Teachers, schools, and society*. New York: McGraw-Hill.
Read: (Chapter 24 & 25) Jones, F. H., Jones, P., & Jones, J. L. T. (2007). *Tools for teaching: Discipline, instruction, motivation*.
Watch: https://search.yahoo.com/search;_ylt=Aizu2YJcLpzb8fOgEYigcyKbvZx4?fr=yfp-t-328-s&toggle=1&fp=1&cop=mss&ei=UTF-8&p=classroom%20management%20videos
Watch: https://search.yahoo.com/search;_ylt=Aizu2YJcLpzb8fOgEYigcyKbvZx4?fr=yfp-t-328-s&toggle=1&fp=1&cop=mss&ei=UTF-8&p=classroom%20management%20videos

Write: Think about the classroom management strategies discusses in the readings and videos. Write a 2-4 page reaction/response paper. Be sure to include how you might use these (effective) strategies or others you have witnessed in your observations in your own classroom. Please be sure to justify your decisions with explicit reference to the readings and videos. Annotate your paper using APA Guidelines.

Assignment 5: (Due Oct. 29)

Read: Sawada, D., Piburn, M. D., Judson, E., Turley, J., Falconer, K., Benford, R., & Bloom, I. (2002). Measuring Reform Practices in Science and Mathematics Classrooms: The Reformed Teaching Observation Protocol. *School Science & Mathematics, 102*(6), 245.

Read: Lyon, E. G. (2013). What about language while equitably assessing science?: Case studies of preservice teachers' evolving expertise. *Teaching and Teacher Education, 32*, 1-11.

Read: Milgram, D. (2011). How to Recruit Women and Girls to the Science, Technology, Engineering, and Math (STEM) Classroom. *Technology & Engineering Teacher, 71*(3), 4-11.

Write: Consider the readings this week specifically regarding linguistic diversity, gender and reformed teaching observation protocol. List three types of students and respond to this question: How will your Lesson Study provide access to the standards for these students? Your response should be 2-4 pages long and specifically address issues from the articles we have read in class as well as your observations.

Assignment 6: (Due Nov. 5)

Read: Murphy, T. J. (2001). Developing Snapshots of Mathematics Classrooms. *College Teaching, 49*(1), 9

Read: Kagan, D. M., & Tippins, D. J. (1992). The evolution of functional lesson plans among twelve elementary and secondary student teachers. *Elementary School Journal, 92*(4), 477.

Read: Wolfe, P. (1987). What the 'Seven-Step Lesson Plan' Isn't! *Educational Leadership, 44*(5), 70.

Write: Choose a lesson format from among those presented in class. You will use this format for your written Lesson Study. Complete an outline of your lesson plan. Details in class.

Assignment 7: (Due Nov. 12)

Read: Anthony, A. B., & Clark, L. M. (2011). Examining Dilemmas of Practice Associated With the Integration of Technology Into Mathematics Classrooms Serving Urban Students. *Urban Education, 46*(6), 1300-1331.

Read: Abd-El-Khalick, F., Bell, R. L., & Lederman, N. G. (1998). The nature of science and instructional practice: Making the unnatural natural. *Science Education, 82*(4), 20.

Read: (Chapter 15) Gomez, A. G., Oakes, W. C., & Leone, L. L. (2006). *Engineering your future: A project-based introduction to engineering*. St. Louis: Great Lakes Press, Inc

Write: Develop an engineering component **AND** a Big "T" technology component for your lesson. Consider the difference between small "t" technology and big "T" technology as described in class. Incorporate at least one component of each in your lesson study. These mini lessons may be given separately or embedded within the lesson.

Assignment 8: (Due Nov. 19)
Read: (pg 15-30) Enriques, L., Colburn, A., & Ritz, W. C. (2006). Developing assessment items: A how-to guide. In M. McMahon, P. Simmons, R. Sommers, D. DeBaets & F. Crawley (Eds.), *Assessment in science: Practical experiences and educational research* (pp. 15-30). Arlington, Va.: National Science Teachers Association Press.
Read: (pgs. 146-171) Wiggins, G., & McTighe, J. (2005). *Understanding by design*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Write: Develop a sample formative assessment and summative assessment for your lesson. Using concepts presented in class, develop at least two formative assessments and one summative assessment to include in your Lesson Study.

Assignment 9: **(Due Dec. 3)**
Read: (pgs. 209-218) Marzano, R. J., Norford, J. S., Paynter, D. E., Pickering, D. J., & Gaddy, B. B. (2001). *A handbook for classroom instruction that works*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Final: Present lessons to class. Complete lesson study. Written report due via email by the beginning of class.

Grading Policy: Assignments are due on the dates noted in the syllabus. Barring extraordinary circumstances, late assignments will not be accepted. Each assignment will contribute to the overall grade in the class according to the weight assigned by category.

A+	97 -100%	C+	77-79%
A	93-96%	C	73-76%
A-	90-92%	C-	70-72%
B+	87-89%	D+	67-69%
B	83-86%	D	63-66%
B-	80-82%	D-	60-62%
F: 59% or below **OR** failure to complete fieldwork hours or submit verification **OR** failure to participate in classes as outlined in the syllabus.			

Class	Date	Topic and Activities	Due
1	**Sept. 24**	Syllabus – Surveys Fieldwork Logistics Overview Science/Math Education in Today's Classrooms Lesson Plan Discussion/Activity	• Survey (In Class) • Fieldwork Contact
2	**Oct. 1**	Understanding By Design ➢ Thinking backwards: keeping the end in mind.	• Journal Entry • Fieldwork Hours • Assignment #1
3	**Oct. 8**	Changing Standards: Common Core and NGSS ➢ Historical perspective on standards	• Journal Entry • Fieldwork Hours

		➢ New Expectations and motivations ➢ Student performance standards, crosscutting concepts in lesson design	• Assignment #2
4	**Oct. 15**	Introduction to Assessment and the 5E Model ➢ What constitutes math/science knowledge? ➢ How are students and teachers to interact in the 5E instructional model? ➢ How is assessment embedded in the 5E instructional model?	• Journal Entry • Fieldwork Hours • Assignment #3
5	**Oct. 22**	Classroom Management ➢ Strategies that work. ➢ Classroom Management versus classroom discipline.	• Journal Entry • Fieldwork Hours • Assignment #5
6	**Oct. 29**	Equity in the Math and Science Classroom ➢	• Journal Entry • Fieldwork Hours • Assignment #5
7	**Nov. 5**	Designing Effective Lessons for New Standards ➢ Components of lessons. ➢ Design of individual lessons. ➢ Thinking backwards: keeping the end in mind.	• Journal Entry • Fieldwork Hours • Assignment #6
8	**Nov. 12**	Science, Engineering and Technology ➢ Engineering's relationship to science. ➢ Who should learn/teach engineering? ➢ Small "t" vs. big "T" technology ➢ Technology: its conceptual role ➢ Technology: Perceptions in Classrooms	• Journal Entry • Fieldwork Hours • Assignment #7
9	**Nov. 19**	Assessment Continued ➢ Purposes of assessment ➢ Formative vs. summative assessment ➢ Assessment: implications for future instruction	• Journal Entry • Fieldwork Hours • Assignment #8
10	**Dec. 3**	Charting a Career in Education ➢ Opportunities and needs in education ➢ Why consider a career in education? ➢ 21st Century Science/Math educators	• Journal Entry • Fieldwork Hours • Assignment #9

Course Requirements:

1. **Fieldwork, Log and Journal (25% and required to receive credit):** All fieldwork hours and journal assignments must be completed in order to receive credit for the course. 30 hours of observation must be completed at the rate of 3 hours per week in a public, secondary school, regular education classroom. Your recorded field hours will be verified against records maintained by your mentor teacher. Two or three short questions based on topics covered during lecture each week will be posted on

iLearn . You will be required to respond to them with brief essays or short answers, usually a paragraph or two. The intention is to develop your critical observation skills in a classroom environment. One of the primary skills teachers need to develop is critical observation. These assignments are a crucial element in your development as a reflective educational scholar.

2. **Weekly Journal Entries (15%):** The overarching theme of the course is *Exploring the Science/Math Classroom of the 21st Century*. While we find ourselves in a time of unprecedented change in education, every educational situation is embedded in a school and community culture with its own unique history and traditions. Journal entries are a way for you to develop your understanding of the current state of education, according to your observations, while comparing and contrasting this with your developing philosophy and your understanding of educational research as related to Science/Math education. Like any learner, your understanding will evolve over time. A record of your thoughts and observations will help you recognize and guide your own development as a professional educator.

3. **Written Assignments (20%):** Each week, a written assignment will be assigned, which will be due the following week. The combined scores on these written assignments will serve as your midterm grade. The final exam will be your presentation to the class of a completed Science/Math Lesson Study Unit. If possible, you will give your lesson in the classroom you are observing. Each weekly assignment will serve to guide a portion of the development of your final lesson study unit.

   Writing Policy - The Graduate School of Education believes that all students should exit its program with strong writing skills. As such, the quality of written composition as well as content will be factored into grades on students' papers for all education courses

4. **Class Participation (15% and required to receive credit):** Each class will include lecture, writing and discussion components. Your full participation will ensure you gain the skills and knowledge necessary to complete the assignments. Missing two or more classes during a quarter or habitually showing up late or leaving early may lead to receiving a failing grade for the course.

5. **Final Exam (25%):** The final exam for the course will be a Lesson Study Unit presented during the last meeting. The written and presentation format will be described in class

Statement on Academic Honesty –
Students are expected to conduct themselves and their work in a manner consistent with UCR's policy on academic integrity. Academic misconduct includes, but is not limited to, cheating, fabrication, and plagiarism (e.g., using another's work or ideas without giving credit— intentionally or unintentionally). Submitting your own work more than once (e.g., for this class

and another class, without both instructors' knowledge and permission) is also a form of academic dishonesty and will result in an F. If you are at all unsure of what constitutes plagiarism or other forms of academic dishonesty, consult the UCR website for more information: http://www.conduct.ucr.edu/. Please familiarize yourself with UCR's policies and procedures regarding academic integrity, published in full in the Schedule of Classes.

Course Bibliography

Abd-El-Khalick, F., Bell, R. L., & Lederman, N. G. (1998). The nature of science and instructional practice: Making the unnatural natural. *Science Education, 82*(4), 20.

Anthony, A. B., & Clark, L. M. (2011). Examining Dilemmas of Practice Associated With the Integration of Technology Into Mathematics Classrooms Serving Urban Students. *Urban Education, 46*(6)

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional Moel: Origins and effectiveness. Colorado Springs: BSCS.

Enriques, L., Colburn, A., & Ritz, W. C. (2006). Developing assessment items: A how-to guide. In M. McMahon, P. Simmons, R. Sommers, D. DeBaets & F. Crawley (Eds.), *Assessment in science: Practical experiences and educational research* (pp. 15-30). Arlington, Va.: National Science Teachers Association Press.

Gomez, A. G., Oakes, W. C., & Leone, L. L. (2006). *Engineering your future: A project-based introduction to engineering*. St. Louis: Great Lakes Press, Inc.

Judson, E. (2013). Development of an Instrument to Assess and Deliberate on the Integration of Mathematics into Student-Centered Science Learning. *School Science & Mathematics, 113*(2), 56-68.

Kagan, D. M., & Tippins, D. J. (1992). The evolution of functional lesson plans among twelve elementary and secondary student teachers. *Elementary School Journal, 92*(4), 477.

Lakoff, G., & Nunez, R. E. (2000). *Where mathematics comes from: How the embodied mind brings mathematics into being*. New York: Basic Books.

Lyon, E. G. (2013). What about language while equitably assessing science?: Case studies of preservice teachers' evolving expertise. *Teaching and Teacher Education, 32*, 1-11.

Marzano, R. J., Norford, J. S., Paynter, D. E., Pickering, D. J., & Gaddy, B. B. (2001). *A handbook for classroom instruction that works*. Alexandria, Va.: Association for Supervisionand Curriculum Development.

Milgram, D. (2011). How to Recruit Women and Girls to the Science, Technology, Engineering, and Math (STEM) Classroom. *Technology & Engineering Teacher, 71*(3), 4-11.

Murphy, T. J. (2001). Developing Snapshots of Mathematics Classrooms. *College Teaching, 49*(1), 9.
Paulos, A. P. (2001). *Innumeracy: Mathematical illiteracy and its consequences*. New York: Hill and Wang.

Paulos, J. A. (1988). *Innumeracy: Mathematical illiteracy and its consequences*. Macmillan.

Sawada, D., Piburn, M. D., Judson, E., Turley, J., Falconer, K., Benford, R., & Bloom, I. (2002). Measuring Reform Practices in Science and Mathematics Classrooms: The Reformed Teaching Observation Protocol. *School Science & Mathematics, 102*(6), 245.

Valdez, A. (2012). Assessing Mathematics Classroom Instruction: Observation of Learning Environments (OLE). *Psychology Journal, 9*(1), 35-43.

Wiggins, G., & McTighe, J. (2005). *Understanding by design*. Alexandria, Va.: Association for Supervision and Curriculum Development.

Wolfe, P. (1987). What the 'Seven-Step Lesson Plan' Isn't! *Educational Leadership, 44*(5), 70.