CED 412: Secondary School Mathematics and Science Project-Based Learning

FALL 2012 COURSE SYLLABUS

Time: Fridays 9:15 - 10:45 a.m. plus an estimated 15 hours of field and out-of-class project work
Location: Commerce
Instructor: Mario Eraso, Ph.D.
Assistant Professor
Mathematics Education
Department of Curriculum & Instruction
Office Location: EDS 214 Commerce
Office Hours By Appointment:
Commerce: Friday 11:00-12:00 p.m.
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COURSE INFORMATION

Textbook

Ronis, D. L. (2008). *Project-Based Learning for Math & Science: Integrating Inquiry and the Internet* (2nd Edition). Thousand Oaks, CA: Corwin Press.

Readings, Supplementary Readings:

Kilpatrick, W. H. (1918). The project method. *Teachers College Record*. Vol. XIX, No.4.

Barron, B. J. S., Schwartz, D. L., Vye, N. J., Moore, A., Petrosino, A., Zech, L., Bransford, J. D., and CTGV (1998). Doing with understanding: lessons from research on problem-and project-based learning. *The Journal of the Learning Sciences*, 7(3&4), 271-312.

Metz K. E. (1997). On the complex relation between cognitive developmental research and children's science curricula. *Review of Educational Research*. Spring 1997, Vol. 67, No.1 (151-163).

Hestenes, D. (2010). Modeling theory for mathematics and science education. In R. Lesh, P. L. Galbraith, C. R. Haines and A. Hurford (eds.), Modeling students' mathematical modeling competencies, (pp. 13-41). New York: Springer U.S.

Hunt, E., & Minstrell, J. (1994). A cognitive approach to the teaching of physics. In K. McGilly (ed.), Classroom lessons: Integrating cognitive theory and classroom practice. (pp. 51-74). Cambridge, MA: MIT Press.

Tharp, R. G. & Gallimore, R. (1988). The redefinition of teaching and schooling (Chapter 1, pp. 13-26), A theory of teaching as assisted performance (Chapter 2, pp. 27-43) in Rousing minds to life: Teaching, learning and schooling in social context. New York. Cambridge University.

Williams, S. M. (1992). Putting case-based instruction into context: examples form legal and medical education. *The Journal of the Learning Sciences* 2(4) 367-427.

Herrenkohl, L. R., Palincsar, A.S., DeWater, L.S., and Kawasaki, K. (1999). Developing scientific communities in classrooms: A sociocognitive approach. *The Journal of the Learning Sciences* Vol. 8(3&4) 451-494. Lawrence Erlbaum Associates. Mahwah, NJ.

Riggs, C., Adamson, W. and Siler, C. (2011). Teaching experience in project-based learning course: An exploration of polynomials. Prezi presentation for SED 489 final project at Texas A&M University-Commerce. http://prezi.com/snynixuxlnaj/teaching-experience-in-project-based-learning-course/

http://www.bie.org/about/what_is_pbl/

Course Description:

There has been considerable emphasis in current reform documents concerning inquiry-based activities. A number of strategies have arisen to address inquiry including case-based instruction (Williams, 1992), problem-based learning (Hmelo, 1998) and project-based learning (Blumenfeld et al., 1991). This course will first address the differences between these approaches to inquiry, some historical roots to project-based instruction and finally will attempt to explore the basic ideas and theoretical perspectives underlying project-based secondary mathematics and science instruction. A major hurdle in implementing project-based curricula is that they require simultaneous changes in curriculum, instruction and assessment practices--changes that are often foreign to the students as well as the teachers (Barron et al., 1998). In this course, the students will develop an approach to designing, implementing and evaluating problem- and project-based curricula that has emerged from collaboration with teachers and researchers. Research on project-based instruction has identified four design principles that appear to be especially important: (1) Defining learning appropriate goals that lead to deep understanding; (2) Providing scaffolds such as beginning with problem-based learning activities before completing projects; using "embedded teaching," "teaching tools" and sets of "contrasting cases;" (3) Including multiple opportunities for formative self-assessment; (4) Developing social structures that promote participation and revision.

Student Learning Outcomes:

CED 412 students will have the opportunity to:

- Develop their ability to create an environment for the learning and teaching of mathematics and science that uses the project-based approach.
- Learn about project-based learning to assist them in designing secondary mathematics and science units.
- Explore the connections that exist between project-based mathematics and science learning, and develop social structures that promote participation and revision.

- Develop the ability to allow their future students to use formative self-assessment with the purpose of assessing deep learning in particular mathematics and science topics at various secondary grade levels.
- Relate PBL to its underlying learning theories such as constructivism and situated learning.
- Become familiar with various technological tools that can be useful in PBL development and implementation.

COURSE REQUIREMENTS

1. In-class and online participation via Epsilen (15%)-- Attendance and participation are required during all sessions. The professor strongly recommends that students come to at least one half of the one-and-a-half-hour sessions when conflict of schedules arises. In order to participate effectively, students are required to read articles and book chapters before class. Students are also required to listen actively to other students as well as the instructor, and make appropriate feedback comments. Online participation is based on students replying to focus questions posted by instructor on Epsilen. Students also respond to postings by peers.

2. Project development (35%)-- Students will design a 3 week unit that uses the project-based approach for a secondary mathematics or science class.

3. Project presentation (10%)-- Students will make a twenty minute presentation of their project.

4. Field experience lesson development and implementation (25%)-- Students will meet with and observe classroom teachers, and will teach three times in high school mathematics or science classrooms.

5. Reflection on field experience (15%)-- Students will write an essay reflecting on their field experiences and describing the process of formative self-assessment.

Final Grading:
A =90% - 100%
B =80% - 89%
C < 80%

Plagiarism:
Student work will be expected to show evidence of creativity and the use of critical thinking skills. Merely restating someone else's work is not adequate. If an original work is directly or indirectly quoted, it must be so noted. To do otherwise is plagiarism. Any plagiarism is grounds for a zero on the submitted work, and possibly for failing the course or being expelled from the university.

Written Assignment Requirements:
All written assignments are to be typed and are expected to exhibit professional quality. Written assignments should be prepared according to the Publication Manual of the American Psychological Association (APA style).

You should demonstrate mastery of organizing, structuring, and editing (for all aspects of mechanics) in your writing. Excessive errors in grammar, spelling, and vocabulary will result in the reduction of your score by at most a letter grade.

Student work is expected to be well-written, logical, and easy to read and follow.

In all assignments, you should use 12 point size, Arial or Times Roman font, one-inch margins on all four sides of the page, and text should be double spaced.

Assignments are to be submitted before class starts on the due date. Complete name, date and title are required.

Late assignments will not be accepted without my prior approval.

TECHNOLOGY REQUIREMENTS

Hardware--- Both Macintosh and Windows systems are acceptable
Software ---Word Processor and Calculations Spreadsheet

Connectivity---Reliable internet access through an established internet service provider is required for online learning activities. Students should choose a DSL or cable-modem service where high speed internet is available.

Email---Access to a reliable email service through an established internet service provider is critical for assignment submission and communication with instructor.

Web Browser---Internet Explorer (version 8.0 or greater) or Netscape (version 9.0 or greater) is required. These browsers are available for free in the download areas at:

http://www.microsoft.com
http://www.netscape.com

ACCESS AND NAVIGATION

This course will not be utilizing eCollege.

COMMUNICATION AND SUPPORT

Interaction with Instructor Statement:

The instructor is available before and after class and other posted office hours. The preferred method of communication is via university email. Remember that you are responsible for your learning. I will help you as much as possible, but you must let me know that you are having problems or questions that you cannot answer. As your instructor, I am available to help you in any way possible. Please feel free to call me at the office phone number provided above.

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures:

This is an undergraduate course of 3 credit hours. Because we will be making presentations and discussing course material in whole class and group formats, attendance to all classes and professional conduct is required.

Attendance:

- According to University policy B19, “Students are expected to be present for all class meetings of any course for which they are enrolled.”
- Attendance at all class meetings is required and essential to your success in this course.
- You are expected to attend all classes; be on time; stay until class is dismissed; and be actively engaged in discussions. Your participation will impact your grade.

- Excessive absences will reduce your grade in the course. In the event of an emergency and a missed class, you are responsible for obtaining class materials, assignments, and notes from one of your peers. Please notify me if you anticipate an absence, and provide me with a medical excuse when missing class or handing in late assignments.

Professional Conduct:

- You are expected to demonstrate professional behavior in all that you do. This includes, but is not limited to, refraining from outbursts, communicating appropriately, taking responsibility, and demonstrating initiative. Also be courteous to your classmates as they present their lessons and as they are speaking.
- Thoughtful participation in class discussions is expected. This requires reading the assignments and thinking about them (before class). It also requires coming to class ready to listen to other students as well as the instructor.

ADA Statement:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services
Texas A&M University-Commerce
Gee Library 132
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
StudentDisabilityServices@tamu-commerce.edu

Student Conduct:

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment (see *Code of Student Conduct from Student Guide Handbook)*.

COURSE OUTLINE / CALENDAR

1.	Aug 31	Course introduction and history of PBL
2.	Sep 7	PBL underlying theories of learning and developmental constraints
3.	Sep 14	Case studies and problem-based learning
4.	Sep 21	Project-based learning (Part I: Theory)
5.	Sep 28	Project-based learning (Part II: Practice)
6.	Oct 5	Lesson and Unit planning for PBL
7.	Oct 12	Formative self-assessment and assisted performance
8.	Oct 19	Midterm Exam and Teach #1
9.	Oct 26	Teach #2
10.	Nov 2	Teach #3
11.	Nov 9	Tools for math and science education communities: Epsilen, Ning, Merlot
12.	Nov 16	Symbols and representation in scientific practice
13.	Nov 23	Thanksgiving Holiday
14.	Nov 30	Modeling theory for mathematics and science education
15.	Dec 7	PBL project presentations
16.	Dec 14	Final Exam and Looking ahead to Student Teaching semester