

Education 263B: Curriculum & Instruction in Mathematics, Fall 2009 Tuesdays, 3:15 – 6:05pm

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Introduction

This is the second of a 3-course sequence focused on mathematics teaching and learning. The course sequence is designed to create an opportunity for sustained learning and professional growth. Our goals for the year are to help you...

- increase your knowledge of mathematics and mathematics pedagogy
- examine your own knowledge, beliefs, and assumptions about mathematics, teaching and students
- increase your theoretical knowledge and practical experiences in planning, teaching, and assessing mathematics
- understand the mathematical needs of a diverse range of students
- understand the complexities of diverse, multi-ability classrooms while broadening your repertoire of teaching strategies
- learn from your experiences in schools through informed reflection

This quarter we will examine two crucial and closely connected aspects of classroom instruction: planning lessons and assessing student learning. We will discuss approaches to the “backward design” of curricula (Wiggins & McTighe, 2005), in which educators begin with a vision of the understanding they want their students to achieve and of the dimensions of performance that would demonstrate that understanding. These understandings will be in the context of mathematical domains, which will be explored and mapped. We will consider different forms of assessment, formative and summative, noting the importance of designing assessments that match our instructional goals, assessing understanding in multiple ways, and integrating assessment and instruction. We will also examine dimensions of math instruction teachers must consider as they prepare lessons: informal assessment, participation structures, selection of and implementation of tasks, and the role of the teacher in the lesson. We will discuss “telling” as an instructional strategy, and consider when, what and how it may be effective for teachers to present mathematical information to students. There will be a joint focus throughout the course on research and practice. Journals and other assignments will encourage you to learn from both course readings and your classroom placements through informed reflection.

Throughout the quarter, we will integrate both theory and practice by reading select articles on teaching, as well as analyze actual math curricula in use. For the most part, we will draw on sections of College Preparatory Mathematics (CPM) Geometry. Evaluation copies of these chapters will be provided to you. Although your placement may or may not use these materials, you will gain insights by studying general issues of curriculum design and evaluation. In subsequent quarters, we will consider other published curricula that embody other perspectives in teaching math.

Course Requirements

We expect you to come to class having completed the reading and assignments due for that day and prepared to participate in class discussions and activities. In addition, we expect weekly short reflection to be posted to BlackBoard by the Sunday night before each class (guidelines in separate document). Attendance to all sessions is mandatory. Please give us ample notice if you must be late to or miss a class.

Assignments:

- Assessment Assignment – DUE Friday, November 20
- Classroom Audio Data (Round 1 DUE October 20, Round 2 DUE December 1)
- Journal – DUE Friday, October 16
- Elaborated Lesson Plan Assignment – DUE Monday, November 30

All assignments should be digitally submitted to BlackBoard unless otherwise specified by the instructors. All feedback will be provided digitally within your submitted documents, and either re-posted to BlackBoard or emailed to you.

Assessments and Grading:

Your grade will be based primarily on the quality of the assignments mentioned above. We will also take into account your punctual postings online, your attendance, and your active contributions to class discussions. As with all your work in C&I this year, you may revise and resubmit any written assignment for a higher grade.

Course Schedule

Session #1: September 22, 2008 – Starting with Instructional Goals in Mind

In this session we will engage together in the first stage of *backward design* of curricula (Wiggins & McTighe 2005): the determination of appropriate and mathematically-significant learning goals. We will compare the California and NCTM content standards for Geometry and California Standards Test for Geometry (CST). We will discuss the big ideas and map a domain of geometry content together.

Readings:

Wiggins, G. & McTighe, J. (2005). *Understanding by Design (2nd Expanded Edition)*. Alexandria, VA: Association for Supervision and Curriculum Development. pp. 13-81.

In class, we will give and review:

- National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*. Reston, VA: Author. [Geometry standards for grades 9-12.]
- Mathematics Content Standards for California Public Schools for Geometry. Available online at: <http://www.cde.ca.gov/re/pn/fd/documents/math-stnd.pdf>
- Geometry Connections - CPM – Geometry (Front Matter) pp. 41-49 (on pdf)

Session #2: September 29 – Unpacking State Standards and Lesson Objectives

Mathematical concepts and skills can be understood at varying levels of complexity. Given the heterogeneity of mathematical backgrounds in most classrooms, it is crucial that teachers explore the range of levels with which their particular students can engage successfully, and match learning opportunities with that range. Although students may be ready to engage with mathematical ideas at different levels, effective teachers continue to press their students for increasingly deeper understanding. This session will provide experiences in specifying different levels of understanding for a given mathematical idea.

Readings:

Task 5: Packaging a soda bottle (1999). *Balanced Assessment for the Mathematics Curriculum*. Dale Seymour, White Plains: NY. (pp. vi-xi, pp. 67-80)

Session #3: October 6 – Misconceptions and Common Errors

Veteran teachers, after teaching the same topic or lesson for a number of years, often come to recognize certain conceptual stumbling blocks associated with the topic that invariably plague many of their students year after year. With skill and planning, we can learn to anticipate these challenges for our students and to develop lessons that defuse rather than reinforce them. In this session, we will consider an array of surprising student misconceptions, and we will examine some of the misconceptions and errors most common and disruptive to learners of Algebra and Geometry.

Readings:

Herbst, P. (2002). Engaging Students in Proving: A Double Bind on the Teacher. *Journal for Research in Mathematics Education*, 33(3) pp. 176-203.

Wagner, S. (1993). What are these things called variables? *Mathematics Teacher*. October 1993. pp. 474-479.

Session #4: October 13 – From Objectives to Assessment

After mapping the mathematical terrain in which their students will be working and establishing learning goals for their students, teachers develop assessments that will validly assess student progress toward these goals. In this session we will explore a variety of ways to monitor student learning, considering forms of assessment including, but not limited to, tests and quizzes. We will discuss the importance of understanding in multiple ways and at varying times throughout a unit or course.

Readings:

Black, P. & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, October Issue. pp. 139-148.

Geometry Connections - CPM – Geometry (Front Matter). pp. 58-64 (on pdf)

DUE this week:

Friday, October 16 – Journal #1

Monday, October 19 – Pieces of Assessment Assignment (See assignment syllabus)

Session #5: October 20 – From Assessment to Instruction

This session continues our conversation about assessment, and begins our discussion of the dimensions of instruction that teachers must consider as they prepare and implement lessons. In this session we will develop the concepts of formative and informal assessment, and discuss the importance of integrating assessment into daily lessons. We will also examine strategies, such as the use of rubrics, self-assessment, and feedback from peers, for helping students learn how to revise and improve their own work.

Readings:

Black, P., Harrison, C., Lee, C., Marshall, B., & Wiliam, D. (2004). Working inside the black box: Assessment for Learning in the Classroom. *Phi Delta Kappan*, September Issue. pp. 9-21.

Lampert, M. (2001) Chapter 11: Teaching the Nature of Accomplishment. In *Teaching problems and the problems of teaching*. pp. 329-359.

Geometry Connections - CPM – Geometry Chapter 1. pp. 1-12 (on pdf)

DUE this week:

Tuesday, October 20 IN CLASS – Pieces of Assessment Assignment (see assignment syllabus)

Tuesday, October 20 IN CLASS - Classroom Audio Data – Round 1

Session #6: October 27 – Tasks Revisited

In the summer we used the Mathematical Tasks Framework (Stein et al 2000) to characterize the cognitive demand of mathematical tasks, and considered how a teacher’s implementation of a task might alter that demand. In this session, we will explore how tasks can be tailored to specific learning goals. We will discuss the flow of tasks, from engaging with students initially, to supporting students as they work on the task, and finally, to distilling with them what they have learned from the experience.

Readings:

Schoenfeld, A. (1988). When good teaching leads to bad results: The disasters of “well taught” mathematics courses. *Educational Psychologist*. 23(2). pp. 1-22.

Driscoll, M., Egan, M., Nikula, J., & DiMatteo, R. W. (2007). *Fostering geometric thinking: A guide for teachers, grades 5-10*. (pp. 7-24). Portsmouth, NH: Heinemann.

Geometry Connections - CPM – Geometry Chapter 1, pp. 13-20 (on pdf)

Session #7: November 3 – Activity Structures

As teachers choose tasks and plan mathematical activities they must decide how they will have their students work on those tasks and activities. Will students work alone? In pairs? In groups? As a whole class? What are the expectations of students in each? What are the affordances of each? Which match particular tasks better than others? In this session we will consider the potential advantages and disadvantages of a few different activity structures.

Readings:

Chazan, D. (2000). *Beyond formulas in mathematics and teaching: Dynamics of the high school Algebra classroom*. Teachers College Press: New York. pp. 6-12 and 120-128.

Geometry Connections - CPM – Geometry TBA

DUE this week:

Tuesday, November 3, IN CLASS – Pieces of Assessment Assignment (see assignment syllabus)

Session #8 – Classroom Observation

For this session we will meet at a local high school to observe different math teachers during the week of November 9-13.

Day, time and focus TBA.

Session #9: November 17 – Telling

In this session we will discuss “telling” as an instructional strategy, and consider when and how it may be effective for teachers to present mathematical information to students. We will watch and experienced teacher deliver an instructional explanation, and practice crafting explanations together.

Readings:

Lobato, J., Clarke, D., & Ellis, A.B. (2005). Initiating and eliciting in teaching: A reformulation of telling. *Journal for Research in Mathematics Education*, 36(2), 101-136.

DUE this week:

Friday, November 20 – Assessment Assignment

NO CLASS NOVEMBER 24.

DUE this week:

Monday, November 30 – Elaborated Lesson Plan Assignment

Session #10 Dec 1 – Presentations

In this session participants will make a brief presentation of the findings of the Assessment Assignments. We will also look back across the themes of the quarter, synthesizing what we have learned and posing the questions that still linger.

DUE this week:

Tuesday, Dec 1 – Classroom Audio Data – Round 2