

Education 263A: Curriculum and Instruction in Mathematics
Room TBA; Mondays – Thursdays, 2:15-5:05
June 29- July 10, 2009

Megan W. Taylor
meg11@stanford.edu

Office: CERAS 217

Office hours: by appointment
(415)999-5827

Kristina Dance
kristinadance@gmail.com

Office hours: by appointment

Introduction

This is the first of a 3-course sequence focusing on mathematics teaching and learning. The course provides an opportunity for sustained learning and professional growth. Our goals are to help you:

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

Throughout the three-course sequence, we will consider two frameworks, one presenting an interwoven conception of mathematical proficiency (National Research Council, 2001) and the other NCTM's *Principles and Standards for School Mathematics* (2000), which sets out standards for mathematical content as well as important practices such as problem solving, reasoning, proof, communication, and representation.

A central theme of the first of the three quarters is classroom ethos and the ways in which teachers may establish positive teaching environments in which *all* students are challenged to learn mathematics. We will draw from K-12 mathematics education research as one entree, including some of the seminal research in the field from elementary and middle-school classrooms. We will analyze teaching practices in many ways, considering the role played by mathematics, the teacher and the students in the production of different environments. Several different examples of practice will be analyzed on video. We will also engage in mathematical tasks that will place you as learners of mathematics and pedagogy. We will consider the acts of listening to students' mathematical thinking and asking important questions in order to probe and further understanding. There will be a joint focus throughout the course on research and practice.

Course Requirements

We expect you to come to class having completed the reading and assignments due for that day and to be prepared to participate in class discussions and activities. Your participation depends upon your timeliness in attendance. If for any reason you will miss or be late to class, please email one of the instructors ahead of time. In the summer quarter you will be required to complete three assignments,

conduct readings (see Course Schedule) and complete daily tasks, which will be described during class.

Major Assignments:

- Math History: Due by 2pm – Monday, June 29th (the first day!)
- Two Summer Journals: Due by 2pm – Thursday, July 2nd and Thursday, July 9th
- Two “In the Classroom” Presentations – Tuesday, July 7th and Friday, July 10th
- Teaching Analysis: Due by 5pm – Sunday, July 12th

All assignments should be submitted in Microsoft Word document form by email to either Kristina or Megan. We will announce to whom assignments are due as the course progresses. The Math History assignment, due on the first day of class, is the only assignment that should be submitted to both instructors.

Your Grade:

This quarter your grade will be based on the quality of the Teaching Analysis (50%) assignment and timely completion of the Math History (10%), In the Classroom presentations (10%), and Summer Journals (10%). We will also take into account active and respectful contributions to class discussions (20%).

Required Text:

Boaler, J. (1997). *Experiencing School Mathematics: Traditional and Reform Approaches To Teaching and Their Impact on Student Learning*. [Various Publishers]

Course Reader (from CopyAmerica on California Ave.) OR download readings from our BlackBoard class website.

Periodic additional readings will be announced in class and posted online.

Course Schedule

Session 1 – Monday, June 29th : Teachers, Students and Mathematics

In our first class, we will introduce the class and instructors, outline our goals for the course, and describe the assignments for the summer quarter. We will consider what it means to establish a positive classroom environment, in this class and in your own classes. We will conduct a mathematics investigation and reflect upon the mathematics, upon your own learning and upon pedagogy.

Reading for this session:

- Hiebert, J., Carpenter, T.P., Fennema, E., Fuson, K., Wearne, D., Murray, H., Olivier, A. and Human, P.: 1997, *Making Sense: Teaching and Learning Mathematics with Understanding*, Heinemann, Portsmouth, NH. [Chapter 1: Introducing the Critical Features of Classrooms, pp. 1-12.]
- Wilson, S. (2003). Chapters 1-2. *California Dreaming: Reforming Mathematics Education*. Integrated Publishing Solutions. New York, NY. (Chapter 1: pp. 1-5; Chapter 2: 6-27).
- Boaler (1997). Chapters 1-3.

* Due: *Mathematics History Assignment*. Email to BOTH Megan and Kristina.

Session 2 – Tuesday, June 30th : What is Mathematical Proficiency?

In this session, we will consider the nature of mathematical proficiency, drawing upon two frameworks. We will discuss the mathematical process standards – Problem-solving, Reasoning and Proof, Communication, Connections, and Representation – outlined in the NCTM (2000) *Principles and Standards for School Mathematics*. We will also draw upon the different dimensions of mathematical proficiency defined by a leading group of mathematics educators and mathematicians in the National Research Council's (2001) report *Adding it Up*. We will consider what these dimensions look like in practice, and how they may be encouraged in teaching, through consideration of some different examples of teaching.

Readings for this session:

- National Research Council (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford, and B. Findell (Eds.). Mathematics Learning Study Committee. Washington, DC: National Academy Press (Chapter 4: pp. 115-135).
- National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM (pp. 52-71).

Session 3 – Wednesday, July 1st : The Nature of Mathematical Tasks

A critical feature of mathematics teaching and learning environments is the task given to students. In this session we will consider the nature of mathematical tasks and the teacher's role in instruction. What are the different types of tasks a teacher might design and what are the cognitive demands of such tasks? How does the design of the mathematical task encourage or constrain thinking? Using the Mathematical Tasks Framework (Stein, Smith, Henningsen & Silver, 2000), we will examine various mathematical tasks and discuss the impact they may have on students' learning experiences.

Reading for this session:

- Stein, M.K., Smith, M.S., Henningsen, M.A. & Silver, E. (2000). *Implementing standards-based mathematics instruction*. Teachers College Press: New York, (Chapters 1 & 2: pp. 1-7; 11-32).
- Boaler (1997). Chapters 4-5.

Session 4 – Thursday, July 2nd : Classroom Culture and the Establishment of Sociomathematical Norms

You have now seen a range of mathematical teaching environments. In this session, we will focus on the norms, and in particular the sociomathematical norms, of classrooms. We will discuss how norms are established by looking at an example of teaching from a secondary classroom.

Readings for this session:

- Kazemi, E. (1998). Discourse that promotes conceptual understanding. *Teaching Children Mathematics*, 4(7), 410 - 414.
- Boaler (1997). Chapters 6-7.

**** Due: Summer Journal Assignment 1. Email to Kristina or Megan by 2pm.**

Session 5 – July 7th : Role of the Teacher

To develop the forms of mathematical understanding that we want for students, we need to consider the role of the teacher in maintaining both cognitively rich tasks and cultivating the norms that support deep learning. We will contrast different roles that teachers play and how these shape the learning that is possible.

We will also have our first round of “In the Classroom” presentations.

Readings for this session:

- Hiebert, J., Carpenter, T.P., Fennema, E., Fuson, K., Wearne, D., Murray, H., Olivier, A. and Human, P.: 1997, *Making Sense: Teaching and Learning Mathematics with Understanding*, Heinemann, Portsmouth, NH. [Chapter 3: The Role of the Teacher, pp. 29-41.]
- Stein, M. K., Smith, M. S., Henningsen, M. A., & Silver, E. A. (2000). *Implementing standards-based mathematics instruction: A casebook for professional development*. New York: Teachers College Press. [Chapter 6: Multiplying Fractions with Pattern Blocks, pp. 65-80.]
- Boaler (1997). Chapter 8.

**** Due: “In the Classroom” Presentation #1.**

Session 6 – Wednesday, July 8th : Listening to Student Thinking

Attending to student thinking is central to effective mathematics teaching. In order to design tasks and ask questions that both probe and further students’ understanding, teachers need to listen carefully to students’ ideas. In this session, we will practice listening to students.

Readings for this session:

- Schifter, D. (2001). Learning to see the invisible. What skills and knowledge are needed in order to engage with students' mathematical ideas? In T. Wood & B. Scott Nelson & J. Warfield (Eds.), *Beyond classical pedagogy: Teaching elementary mathematics*. Mahwah, NJ: Lawrence Erlbaum Associates (pp. 109-134).
- Boaler (1997). Chapter 9.

Session 7 – Thursday, July 9th : Exploring Student Thinking

In this session, we revisit our focus on listening to students, and consider what it means to organize a classroom around student thinking. How do teachers make student thinking visible? How do they work with students ideas? We will consider what is involved in creating a classroom community oriented around student thinking.

Readings for this session:

- Skemp, R. (1978). Relational understanding and instrumental understanding. *Arithmetic Teacher* 26 (3), pp. 9–15.
- Boaler (1997). Chapters 10-11.

**** Due: Summer Journal Assignment 2. Email to Megan or Kristina by 2pm.**

Session 8 – July 10th : Equitable Mathematics Teaching and Learning

In this session we will explore the question of what equitable practices of mathematics teaching and learning look like, using ideas from all seven sessions. What does it mean to develop these practices? How can you promote understanding for students with diverse learning needs? What factors play into promoting classrooms that are equitably accessible? We will also have our second round of “In the Classroom” presentations.

Readings for this session:

- Moses, R.P., Kamii, M., McAllister Swap, S., Howard, J. (1989). The Algebra Project: Organizing in the Spirit of Ella. *Harvard Educational Review*, 59(4), 423-443.

**** Due: “In the Classroom” Presentation #2.**

Final Assignment

*****Teaching Analysis Assignment due Sunday, July 12th. Due by email to Megan or Kristina by 5pm.**