05:300:341 Modern High School Mathematics Fall 2011

Course details

Meets: Monday & Wednesday, 2:50-4:10 , ED25A
Instructor: Dr. Keith Weber
E-mail: keith.weber@gse.rutgers.edu
Tel: (732) 932-7496 x8123

Background

Since the NCTM published their *Standards for School Mathematics* in 1989, there has been a significant change in the way that mathematics courses have been taught. Prior to this publication, mathematics courses were centered around giving students a *procedural understanding* of mathematics—that is, the goal of these classes was for students to recognize situations when a procedure (e.g., adding fractions, solving a linear equation) would be useful and apply the procedure correctly. After this publication, the emphasis shifted to teaching for *conceptual understanding*—students are now expected to:

- know *why* the rules they are applying work
- be able to *represent* and think about math concepts in meaningful ways.
- see connections between the concept they are studying and other mathematical topics

Achieving these goals puts new and challenging demands on teachers. They now not only need to know the collection of mathematical procedures that students will learn, but also why the procedures work, how the relevant concepts can be represented, and how to help students learn these things. Many teachers lack this knowledge. For instance, most mathematics teachers are familiar with the fact that $\log_b x + \log_b y = \log_b xy$. However, many mathematics teachers cannot explain why this rule is true. The result of this is that these teachers cannot design lessons to help students understand why rules like this are true because the teachers do not understand why themselves. Modern High School Mathematics is designed to address this gap by looking at high school mathematics in a deeper way.

Goals of this course

The primary goal of this course is for you to develop a deep understanding of the concepts of high school mathematics. At the end of this course, you should be able to understand and explain why the procedures learned in high school mathematics work, describe different ways of representing important concepts, and explain the relationships different mathematical concepts.

Secondary goals of this course include: recognizing the importance for students and teachers to have a conceptual understanding of mathematics; thinking deeply about what it means to understand a mathematical concept; discussing what type of teaching can help students understand concepts and what type of teaching might be counterproductive to this goal; recognizing when your understanding of a concept is not as strong as you'd like it to be and seeing the need to remedy this situation; and gaining a general familiarity with main ideas of mathematics education (such as the NCTM's *Principles and Standards* and the NJ Core Content Standards).

Grade for the course
Your grade for the course will be composed of the following:

- *In class assignments* (20%)- Every three weeks or so, you will be asked to give a brief (10 to 15 minute) presentation, either on an education or mathematical topic. Usually these will be presented with groups of three to five students.
- *Final exam* (20%)- You will be given a take-home final at the end of term to assess whether you can apply the conceptual understanding of the material that was covered.
- *Two classroom presentations and papers* (40% total, 20% each)- You will develop two lessons. For your mid-term assignment, with a group of students, you will choose a challenging mathematical topic and develop activities to teach it to your classmates. For your final project, you will write a lesson plan designed to help students develop a deep understanding of a mathematical concept.
- *Class participation* (20%)- You will write journal entries discussing the readings and the ideas presented in the class.

Textbook
There is no textbook for this course.

Policy on Academic Integrity
Please refer to the Policy on Academic Integrity for Undergraduate and Graduate Students at http://academicintegrity.rutgers.edu. I will follow the policy strictly.

Academic honesty
The University Code of Student Conduct can be accessed at:
http://rci.rutgers.edu/%7Epolcomp/judaff/ucsc.shtml
For information on the academic integrity policy, please go to:
http://academicintegrity.rutgers.edu/integrity.shtml#I
Related regulations may also be found in the Rutgers Graduate School of Education Catalog. For any and all assignments and class activities, including in-class quizzes, take-home quizzes, tests, papers, field projects, PowerPoints, and any other class related work, no copying of any kind is allowed, unless copied text is placed within quotations and author/ source is appropriately cited. Clear evidence of extensive plagiarism will likely result in a grade of F for the assignment AND course.

Tentative course schedule
(Subject to change)

Week	Topic	Assignments due
1	Introduction, algebraic manipulations	Skemp reading
2	Area model	NCTM Principles
3	Primes, exponents, logarithms	Ma (Chapter 1)
4	Geometric congruences	Davis reading
5	Trigonometric functions	NCTM Content Standards
6	Complex numbers	Ma (Chapter 2)
7	Variables	Thompson reading
8	Functions	NCTM Process Standards
9	Function composition and translation	NJ Core Content Standards
10	Derivative, integral	Rough draft, Lesson plan due
11	Taylor series	Ma (Chapter 4)
12	Fundamental Theorem of Calculus	Final Exam due
13	Student presentations	Lesson plan, unit plan
14	Student presentations	Lesson plan, unit plan