Introduction to Mathematics Education, Fall 2011 (15:254:540 Sec. 01)
HYBRID COURSE (Index # 21118)
On-Campus Meeting Dates: 9/14, 9/21, 9/28, 10/12, 10/26, 11/2, 11/16, 12/7, 12/14
Wednesdays, 4:50-7:30, GSE Room 30
Graduate School of Education, 10 Seminary Place
Professor Carolyn A. Maher

CONTACT INFO

Instructor	Carolyn Maher	carolyn.maher@gse.rutgers.edu	(732) 932-8848
Assistant Instructor	Marjory Palius	marjory.palius@gse.rutgers.edu	(732) 932-7496 x 8159
Course Web Support	Robert Sigley	robert.sigley@gse.rutgers.edu	(732) 932-7496 x 8161

OFFICE HOURS

Wednesdays (on-campus dates only), 3:30-4:30 and by appointment

OBJECTIVES

This course is designed to introduce participants to the field of mathematics education through a variety of activities that blend in-person, on-campus sessions with interactions done asynchronously online through a course web site. The on-campus activities will be to work in small groups on mathematical problem-solving tasks, with consideration of how K-12 students might engage with those tasks as they build solutions to problems. The online course work will include reading assignments that introduce participants to theoretical perspectives on learning and research in math education, with guidelines for engaging in reflection and discussion of those readings and considerations of their relevance to teaching practices. Other online course work will include studying video clips of children engaged in math problem solving and talking about their mathematical ideas; through reflection and online discussion the videos will be connected to the readings and hands-on problem solving. Emphasis will be on the mathematics, children's learning, and conditions of the learning environment. We will focus on the content strand of counting and combinatorics, from early years through high school, and consider implications drawn from research for instruction in light of NCTM Standards.

This course also is designed as a site for examining how teachers can learn about students' mathematical reasoning through studying videos that feature children doing thoughtful mathematics. Part of that process entails first engaging as a learner with cognitively challenging tasks by working with a partner or small group, and then attentively viewing videos of students who engage with those same tasks. You will complete assessments (pre and post) for measuring the impact of course activities in the focal mathematical strand on what you notice and how you describe what you observe in an example video and on beliefs about learning and teaching math. You will be given a consent form about whether your assessments can be among those analyzed for ongoing research. Completing the assessments is not optional; it is a course requirement.

COURSE REQUIREMENTS

You are invited to be an active participant in the class through small group work in the classroom and though web-based discussions, projects, lectures and writing. Successful completion of the course requires that you engage in all activities and submit all assignments. You are required to:

1. Complete all pre- and post-assessments.

2. Attend all on-campus sessions and lectures.

3. Actively participate in online discussions as you engage with assignments (readings and videos) and respond to guiding questions as posted on the eCompanion course web site. You are required to make at least one original posting and respond to at least two group member postings per week.

4. Be knowledgeable of all the assigned readings and video clip viewings.

5. Prepare a teaching philosophy statement. Note that this is a GSE requirement for the Introduction to Mathematics Education course. More information will be provided to you with ePortfolio instructions, requirements, and rubric for evaluating your statement. It will be due by November 16. This is a personal philosophy of teaching, which should include the following elements:
   a. Age group for which you are considering this personal statement of teaching
   b. What you think the purposes of schooling should be
   c. Your position on the questions or problems central to your discipline
   d. How students learn
   e. How you will teach
   f. Why and how you will respond to differences in ability, interest and background of your students

6. Complete an *Individual Project* about the learning of a particular mathematical concept using *Video Mosaic* (www.videomosaic.org) resources to tell the story. This innovative assignment is perhaps best described as composition of a multimedia paper that builds a narrative to trace learning through provision of relevant video-based evidence showing the development of how students come to learn a particular mathematical concept. While the multimedia paper will be constructed and saved in the Video Mosaic site, you also will compose an abstract of your paper (due Nov. 30) to share on the eCompanion course site to stimulate questions for class-wide discussion on Dec. 7.

7. Complete a *reflection paper* about your work in this course to include online discussions about videos and readings, guest speakers and project work. This will be the final assignment and due on December 14. You should reflect on your knowledge of the mathematics, research on how students learn, and implications for teaching with regard to NCTM Standards. You may review your postings on the course web site and notes from problem solving and sharing of solutions as you develop your reflective assessment.

COURSE OUTLINE AND ASSIGNMENTS

9/7/2011 ONLINE ASSIGNMENT	**Assignments – pre-assessments, readings, and respond online to guiding questions:** Complete pre-assessments using the eCompanion course web site. These assessments must be completed prior to the on-campus class session on Sept. 14. After completing the assessments, the reading assignment is: **(1)** Erlwanger, S. H. (1973). Benny's Conception of Rules and Answers in IPI Mathematics. *The Journal of Children's Mathematical Behavior* 1(2), 7-26.
9/14/2011 ON-CAMPUS	**Class Activities:** Introduction to the course; Engage in problem-solving task from early grades counting strand with problem extensions and focused discussion about representations; Review syllabus and discuss course requirements; Do content test. **Assignments – readings, videos and respond online to guiding questions:** **(1)** Maher, C. A. & Martino, A. M. (1992). Teachers building on students' thinking. *Arithmetic Teacher, 39*(7), 32-37. **(2)** Maher, C. A. & Weber, K. (2010). Representation Systems and Constructing Conceptual Understanding. Special Issue of the *Mediterranean Journal for Research in Mathematics Education 9*(1), 91-106. **(3)** Combinatorics book (Maher, Powell & Uptegrove, Eds.)*, chapters 1 & 2 **(4) Videos:** Shirts/Pants, Grades 2 & 3
9/21/2011 ON-CAMPUS	**Class Activities:** Engage in task for building towers 5/4/3/n-tall; Extend problem solving to "Guess My Tower" task; Discuss heuristics and problem solving for early tasks in counting strand, and ideas from assigned readings. Introduce Projects **Assignments – readings, videos and respond online to guiding questions:** **(1)** Maher, C. A. & Martino, A. M. (1996). The development of the idea of mathematical proof: A 5-year case study. In F. Lester (Ed.), *Journal for Research in Mathematics Education, 27* (2), 194-214. **(2)** Maher, C. A. (2009). Children's reasoning: Discovering the idea of mathematical proof. In M. Blanton, D. Stylianou and E. Knuth (Eds.), *Teaching and learning proof across the K-16 curriculum* (pp. 120-132). New Jersey: Taylor Francis - Routledge. **(3)** Weber, K. (2008). How mathematicians determine if an argument is a valid proof. *Journal for Research in Mathematics Education, 39* (4), 431-459. **(4)** Iannone, P., Inglis, M., Mejía-Ramos, J. P., Simpson, A. & Weber, K. (2011). Does generating examples aid proof production? *Educational Studies in Mathematics 77*, 1-14.
9/28/2011 ON-CAMPUS	**Class Activities:** Review tower building, discuss papers up to that point. **Guest speaker:** Dr. Keith Weber, "Using qualitative and quantitative research methods to investigate mathematical reasoning, teaching, and learning" **Assignments – readings, videos and respond online to guiding questions:** **(1)** Combinatorics book, Chapters 3, 4 and 5 **(2) Videos:** Building towers clips from grades 4 & 5; Interview with Meredith **(3)** Davis, R. B. (1992). Understanding 'understanding' (1992). *The Journal of Mathematical Behavior, 11*, 225-241.

10/5/2011 ONLINE ASSIGNMENT	**Class Activities:** Engage in a pizza problem task: pizzas with halves, selecting from 4 toppings; pizzas, selecting from 4 toppings; pizzas, selecting from n-toppings. Share how solutions were found and examine representations used in problem solving; Consider whether justifications offered are convincing and why / why not; Watch Brandon video and share observations / impressions; Discuss readings; Support for projects: status of transcription and verification **Assignments – readings, videos and respond online to guiding questions:** **(1)** Maher, C. A. & Martino, A. (1998). "Brandon's Proof and Isomorphism". In C. A. Maher, *Can teachers help children make convincing arguments? A glimpse into the process.* Rio de Janeiro, Brazil: Universidade Santa Ursula. **(2)** Combinatorics book, Chapters 6 **(3) Videos:** PUP-Math Pizza clips
10/12/2011 ON-CAMPUS	**Class Activities:** Introduce "Ankur's Challenge" as problem-solving task; **Assignments – readings, videos and respond online to guiding questions:** **(1)** Combinatorics book, Chapter 8 **(2)** Yackel, E. & Hanna, G. (2003). Reasoning and proof. In J. Kilpatrick, G. W. Martin, and D. Schifter, (Eds.), *A Research Companion to Principles and Standards for School Mathematics* (pp. 227-236). Reston, VA: National Council of Teachers of Mathematics. House E. 1980. *Evaluating with validity*. Sage Press, Beverly Hills. **(3) Videos:** PUP-Math Romina's proof
10/19/2011 ONLINE ASSIGNMENT	**Online Activities:** Respond to the guiding questions to be posted online for engagement in threaded discussion about ideas from recent problem solving activities and related videos and readings, with focus on reasoning and proof in mathematics. **Assignments – readings and respond online to guiding questions:** **Assigned readings:** **(1)** JRME Monograph #4**, Introduction and Chapters 5 and 6
10/26/2011 ON-CAMPUS	**Class Activities:** Engage in exploration of binomial expansion; Discuss readings. **Assignments – readings, videos and respond online to guiding questions:** **(1)** Maher, C. A. & Speiser, R. (1997). How far can you go with block towers? Stephanie's Intellectual Development. *The Journal of Mathematical Behavior, 16*(2), 125-132. **(2)** Combinatorics book, Chapter 7 **(3) Videos:** Clips from interviews with Stephanie
11/2/2011 ON-CAMPUS	**Class Activities:** Exploration of Pascal's Triangle; Investigation of meaning behind symbolic notation – Why does the addition rule work? Discussion of readings. Engage in the Taxicab Problem and share ideas that emerge from the task. **Assignments – readings, videos and respond online to guiding questions:** **(1)** Combinatorics book, Chapters 12 and 13 **(2) Videos:** Night Session clips and Taxicab clips **(3)** Battey, D. (2011). "Good" Mathematics Teaching for Students of Color: Critical Relational Interactions in the Mathematics Classroom. [full citation to be provided – manuscript undergoing revisions for publication]

11/9/2011 ON-CAMPUS	**Class Activities:** Review Pascal's triangle, discuss readings. **Guest speaker:** Dr. Dan Battey, *"Good" Mathematics Teaching for Students of Color: Critical Relational Interactions in the Mathematics Classroom* **Assignments – readings, videos and respond online to guiding questions:** A Brief History of American K-12 Mathematics Education in the 20th Century *Mathematical Cognition: A Volume in Current Perspectives on Cognition, Learning, and Instruction*, p. 175-225.
11/16/2011 ON-CAMPUS	**Class Activities:** Expanding Pascal's Triangle with three variables. PORTFOLIOS DUE (Teaching Philosophy statement) – submit to Sakai site **Assignments:** respond online to guiding questions (about ideas generated from classroom problem solving activities)
11/21/2011 ONLINE ASSIGNMENT	**Online Activities:** Use *Video Mosaic* site for composition of multimedia paper as you work on individual projects. **Assignments – readings and respond online to guiding questions:** **(1)** JRME Monograph #4, Chapters 1, 2 and 3
11/30/2011 ONLINE ASSIGNMENT	**Online Activities:** Use *Video Mosaic* site for composition of multimedia paper **Assignments:** Continue work on individual projects. Post abstract summarizing your own project. Read abstracts of classmates' project to prepare for class discussion on Dec. 7. Post questions / concerns that you'd like to address in class-wide discussion.
12/7/2011 ON-CAMPUS	**Class Activity:** Discussion of ideas / questions emerging from review of abstracts about individual projects. **Assignments:** Complete the online post-assessments.
12/14/2011 ON-CAMPUS	**Class Activity:** Wrap up discussion of projects and/or address any other open items. Do content-based post-assessment. *Reflection Paper DUE*

Notes about reading assignments:

Several readings come from two required texts, which are listed below. From SpringerLink.com students may purchase a "MyCopy" edition of eBook for Combinatorics and Reasoning at cost of $24.95. The JRME Monograph #4 is available for purchase from NCTM (nctm.org) at the non-member price of $16.95 (NCTM members can purchase for discounted price). The other assigned readings will be made available through the eCompanion site for this course.

* Maher, C. A., Powell, A. B. & Uptegrove, E. (Eds.), (2010). *Combinatorics and reasoning: Representing, justifying and building isomorphisms*. Springer Publishers.

The JRME Monograph #4 is:

** Davis, R. B., Maher, C. A. & Noddings, N. (Eds.). (1990). Constructivist views on the teaching and learning of mathematics: Journal for Research in Mathematics Education, Monograph No. 4. Reston, VA: National Council of Teachers of Mathematics.

How course grades will be determined:

Online discussion will be 45% of grade, for which contributions are evaluated for their quality in terms of how they reveal extent of understanding about assigned readings and videos you study. Instructors are not interested in actually counting contributions, but it will be noticed if someone is not posting to discussion per course requirements. There is no way to "make up" for not posting in a given week, other than to go back to it later to add your comments - but since that does not enable others to interact with your ideas because they've already moved on, it has the effect of diminishing the value of your contributions. Thus, it is better to be more active in the current week, perhaps by making explicit connections to ideas discussed in previous weeks.

In-class work will be 25% of grade, and thus is based on attendance, problem solving, discussion, and whatever else constitutes your contributions to on campus class meetings. The idea is that you must show up in order to participate in what the class does that day. There also is no way to "make up" for missed sessions on campus; however, any student missing the opportunity to work in class on a problem-solving task will need to work independently on the problem in order to stay current with assigned readings, video clips, and threaded discussion as online homework.

Individual projects, encompassing both the multimedia paper and the abstract, will be 10% of grade. Project work will be evaluated for the clarity and strength of the narrative you construct using evidence that traces learning of a particular mathematical concept. It is an opportunity to be creative as you blend ideas from readings, properly cited, with segments of video to convey the learning process. Topics must be approved in advance through consultation with instructor.

Growth in student learning will be 10% of grade, which is measured by how an individual student has improved on her/his content-based post-test from pre-test performance. The idea is that students enter this course with varying backgrounds, and each person is expected to grow from wherever she/he was at beginning of term. Assessment involves both problem solving content knowledge and aspects of pedagogical content knowledge particularly relevant to mathematical reasoning.

Final reflection papers must be submitted to satisfy course requirements. While they do not factor into grade, the expectation remains that the assignment is to be completed with the same care and quality effort as graded course work.

Teaching philosophy statements are evaluated using standardized rubric developed for this particular contribution to the Teacher Education Portfolio. Timely submission of your statement must be made to satisfy course requirements, but your score does not factor into course grade.

Policy on Academic Integrity
You are responsible for knowledge of and will be held accountable to the Academic Integrity at Rutgers policy found at http://academicintegrity.rutgers.edu.

As a general guideline for engaging in online discussions, we offer a few words on "Netiquete." This is drawn from Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace*. San Francisco: Jossey-Bass, p. 101.

- Check the discussion frequently and respond appropriately and on the subject
- Focus on one subject per message and use pertinent, informative, and not-too-long subject titles
- Capitalize words only to highlight a point or for titles. Capitalizing otherwise is generally viewed as SHOUTING
- Be professional and careful with your online interaction
- Cite all quotes, references, and sources
- When posting a long message, it is generally considered courteous to warn readers at the beginning of the message that is a lengthy post
- It is inappropriate to forward someone else's message(s) without their permission
- Use humor carefully. The absence of face-to-face cues can cause humor to be misinterpreted as criticism or flaming (angry, antagonistic criticism). Feel free to use emoticons such as :-) or ;-) to let others know that you're being humorous.