N443: Teaching Elementary School Mathematical Problem Solving
Syllabus
Spring Semester 2010

Instructor
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A little about me: I taught middle and high school students for 9 years in L.A. and outside of Chicago. Then for 2 years I was a mathematics assistant to teachers in an elementary school in Georgia. I have now taught prospective and in-service teachers for 4 years in Georgia; Portland, Oregon; and Indiana. I love teaching students of all ages and look forward to working with you.

Class Times and Location
Tuesdays and Thursdays 4:00 pm – 5:15 pm, ED 3025

Office Hours
Tuesdays and Wednesdays from 2:30 – 3:30 pm, or by appointment. Feel free to email or stop by my office at any time; if I can’t talk right then we can arrange for another time.

Required Texts and Materials


Jackiw, Nicholas. (2001). The Geometer’s Sketchpad, Version 4 (computer program). Emeryville, CA: Key Curriculum Press. Available at the Stat/Math Center on campus, located at 410 North Park Avenue (www.indiana.edu/~statmath/) for $25. Please call ahead and they will burn a CD for you: 812-855-4724. If you choose to buy from Amazon or www.keypress.com, you’ll pay about $40. **Version 5 is now available; you can purchase that one if you can bring your own laptop to class.**

Thumb drive. Please get one of these and bring it regularly to class so that you can transfer files between your own computer and in-class laptops.

Supplemental Texts and Materials
We will also read some articles from Teaching Children Mathematics (TCM) and Mathematics Teaching in the Middle School (MTMS), two journals for teachers that are published by the National Council of Teachers of Mathematics. When you join NCTM, you gain access to one on-line journal and the e-Standards, free registration for conferences, and a discount on NCTM materials. For details, see http://www.nctm.org/membership/content.aspx?id=7618

Electronic Conference and Mail
I will post assignments, overheads and notes shown in class, urls, some readings, questions about the readings, and other important information regularly to Oncourse. Please become familiar with Oncourse use by the second week of classes. You are expected to check Oncourse and email regularly.

Important Dates (note that most due dates are tentative)

<table>
<thead>
<tr>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Class begins</td>
<td>2 TCM or MTMS</td>
<td>4 Midterm exam due</td>
<td>22 Final project due</td>
<td>4 Final exam due</td>
</tr>
<tr>
<td>21 First HW due</td>
<td>Crit. Refl. due</td>
<td>16, 18 Spring Break — NO class</td>
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<td></td>
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<td>25 Topic for Final project due</td>
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Course Goals

This course has two major foci.

**The first focus is to rethink and develop your own knowledge of mathematics.** Remember, it is never too late for anyone to learn to reason numerically, quantitatively, spatially, and algebraically in ways that do not emphasize rule-bound manipulation of symbols or formulas. So, a major focus of the course is for you to experience reasoning with numbers, quantities, spatial relations, and algebraic ideas in a way that will serve as a framework and guide as you attempt to help your students to develop their reasoning.

The topics that we will focus on this term are *multiplicative reasoning* with a view toward what is necessary for algebraic reasoning; *fractions, ratios, and proportional reasoning; directed quantity and integers; unknowns and equation solving; and rates, variables, and linear functions*. These are BIG ideas in upper elementary and middle school mathematics, and they are important for reasoning algebraically.

**The second focus is to use your own evolving mathematical knowledge to envision creative possibilities for your students.** To teach mathematics means to orchestrate mathematical thinking and learning for others. So in the course I invite you to use your evolving understanding to envision how you will communicate mathematically with your (future) students, engage them in productive mathematical activity, and design effective mathematical learning environments.

Specific goals of the course are:

1. **To experience the challenge and joy of doing mathematics.** This goal includes engaging actively in solving problems; in questioning, rethinking, and justifying mathematical ideas; and in communicating mathematically with others. It also includes developing *imagery* for your own mathematical thinking and using that imagery to think about how your students may develop their mathematical ideas.

2. **To analyze the mathematical foundations for the BIG ideas listed above, including connections among topics.** This goal involves exploring questions like: What are critical ways of thinking involved in learning fractions? What is involved in learning and using proportional reasoning? What is an unknown? What is a variable? What is an equation? What is the basis for formulating and solving equations? How do people come to understand rates and linear relationships? What is the relationship between pattern-finding and algebraic reasoning?

3. **To use your analysis of the mathematical foundations of BIG ideas to guide your (future) students in building critical mathematical concepts.** This goal includes considering differences between the mathematical thinking of children and adults. It also includes exploring and designing mathematical tasks and activities for elementary and middle school students that will engage them in creative mathematical thinking. Again, *imagery* is critical here!

4. **To engage in discussions about a range of current issues about mathematics teaching and learning.** This goal includes co-creating an environment in which you and your classmates share and justify your thinking, ask questions, make conjectures, and take risks. This goal also involves thinking about ways to design your future classroom to facilitate mathematical learning for all students. Issues to consider include how to engage students in mathematical conversations, use technology creatively and critically, prepare to teach diverse populations of students, and assess the progress of students.

**NOTE:** Working toward these goals will involve exploring and understanding mathematical ideas at a level deeper than you may expect your elementary and middle school students to explore and understand.

***Some of the most important “methods” you have as a teacher of mathematics are (a) your own evolving, creative mathematical thinking; and (b) your evolving understanding of your students’ mathematical thinking and how it can change through engaging students in productive mathematical activity.***
Abridged Description of Course Assignments

I will try to make the purpose of each assignment clear. If you have questions about the purpose of the assignment or what is expected of you, please ask—I am always happy to discuss your concerns with you.

On all written work, I expect you to demonstrate correct use of the English language with regard to grammar, punctuation, and spelling—I do grade on technical writing skills as well as content. Please proofread your work before submitting it. If you have weaknesses in the area of grammar, punctuation, or spelling, find someone who will proofread your work for you before you turn it in (see also the “Guidelines and Evaluation Practices for Written Assignments” handout).

Each of the course assignments has been allotted a certain number of points out of 400 possible points that you can earn in the course. More information on how I will evaluate your assignments will follow, and I will hand out rubrics for each assignment.

All assignments except for #1 (most of the time) and #2 below are to be submitted electronically through Oncourse. Detailed descriptions for all written assignments, including evaluation rubrics, will be distributed at a later time and will also be available through Oncourse. Here are brief descriptions:

1. **Problem Solving Homework**: One of your greatest assets in understanding students’ mathematical thinking is understanding and deepening your own mathematical thinking. Therefore, a significant part of this course is about doing mathematics, generating mathematical conversations, and reflecting on your own mathematical knowledge. We will work on many mathematical problems during the semester. **So, please acquire and keep a 3-ring binder of the problems that we do (in class and for homework). You can expect problems to be assigned weekly, and I will collect homework at least five times during the term.** When I collect your homework I will:
   - evaluate your work for completeness (specified problems worked on thoroughly)
   - read and assess about 5 mathematics problems in detail
   - in some cases, assess your reflection on teaching the topics that we are working on, or your responses to questions about accompanying readings (see #2)

   Each homework assignment is worth 20 points. I will count your best five homework assignments in your course grade, although I will likely collect six or seven assignments during the term. So, problem solving homework is worth 100 points out of the total 400 points for the course (see rubrics on the next page). Homework should be turned in **on the due date by 6 pm**. Late homework will earn penalties as noted below. **In some cases, you will submit problems via Oncourse because during part of the course we will do a good deal of mathematical work with JavaBars and GSP.**

2. **Readings**: For discussions in class, I will ask you to read portions of PSSM, articles, case studies, or curricular materials. In some cases, I may ask you to answer a few questions about a reading (your responses will be part of your problem solving homework assignment, see #1). Note that due to time constraints, we will not always discuss every portion of every reading in detail. That does not mean that the particular article or chapter is not worth reading.

3. **Critical Reflection on a Teaching Children Mathematics or Mathematics Teaching in the Middle School article**: Write a critical reflection on an article from either of these NCTM journals. The article should be recent (published within the last 3 years) and address the topic of algebraic reasoning. In your reflection, give a summary of the main point(s) of the article, describe the mathematical thinking involved in any activity presented, address the strengths and weaknesses of the article, and tell what you have learned from it. Your reflection should be 2-3 double-spaced pages and is worth 20 points.

4. **Curricular/Instructional Project and Class Presentation**: During the term I invite you to develop a project of your choosing and make a presentation to the class. The project is fairly “open-ended” with these three conditions: (a) The project should involve you in developing and solving mathematics problems related to the topics in the course (or possible extensions of them); (b) The project should develop some curricular and/or instructional resources for use with elementary and/or middle school
students; (c) The project should include some use of technology (which can be JavaBars, GSP, online resources, or other software such as Tinkerplots, a terrific program for exploring data and statistics with elementary and middle school students). In your presentation to the class, give a flavor of your project by engaging us in a problem-solving activity. More guidelines for this assignment will be given out during the term. This assignment is worth 100 points.

5. **Midterm Exam and Final Exam**: The midterm and the final exam will both be take-home examinations. Each will be worth 90 points.

**Grading Policies**

- **Grading Standards**: Grades are based on individual performance in all aspects of the course, with grading rubrics provided for all of the assignments. Every attempt will be made to give grades that are close to those suggested by the *Teacher Education Undergraduate Grading Guidelines*. As noted in the guidelines, (1) an A is representative of outstanding performance and (2) “it is virtually impossible to prespecify all details necessary to achieve a given grade.” The guidelines also state “Students should recognize that effort alone does not necessarily guarantee above average grades.” The grade distribution for mathematics methods courses suggests that most students obtain grades ranging between B and B+. However, with grades based on individual performance rather than a comparison to others, the average grade for the course could end up higher or lower than that.

- **Grading of Mathematical Homework**: I will use the either of the following rubrics to evaluate your homework:

<table>
<thead>
<tr>
<th>Rubric A: Problem Solving Homework</th>
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<tbody>
<tr>
<td><strong>Thoroughness</strong> (all problems completed thoroughly)</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Explanation &amp; Analysis of targeted problems</td>
</tr>
<tr>
<td>Mathematical Correctness of targeted problems</td>
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</table>

<table>
<thead>
<tr>
<th>Rubric B: Problem Solving Homework with Teaching Reflection/Reading Qs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thoroughness</strong> (all problems completed thoroughly)</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Explanation &amp; Analysis of targeted problems</td>
</tr>
<tr>
<td>Mathematical Correctness of targeted problems</td>
</tr>
<tr>
<td>Reflection on Teaching and/or Responses to Reading Questions</td>
</tr>
</tbody>
</table>

**A note about Explanation and Analysis…**

You should expect to do a lot of writing on your homework. In general, after you have written an explanation of your mathematical thinking, reread it as if it were someone else’s thinking. Is what you wrote just a sequence of “things to do”? If so, then you haven’t really *explained*; you’ve described, or reported, what you did. In writing explanations, the main idea is to push beyond an account or description by including *reasons* for what you did. Focus on the decisions you made in solving a problem and the *motives or reasons* for those decisions. For example, if you decide something has to be divided into 10
equal pieces, then explain your motives for that—why 10 parts and not 3, for example? You should also note the consequences of your decisions, such as “this length, which I call 1 foot, is now in pieces that are each 1/10 of one foot.” Making consequences explicit gives you—and your reader—additional information about where you’ve been and where you might go next.

- **Policy on Resubmitting Assignments**: If you earn less than 75% of the allocated points on an assignment (other than the Final Exam), you may, if you wish, resubmit the assignment **within two weeks** of the time the original is returned to you (or in the case of the Final Project, **within one week**). **Please notify me immediately that you plan to resubmit the assignment and include the original along with your revised version.** When grading a resubmitted assignment, I look to see that you have revised the assignment based on the comments made on the original. The maximum grade on a resubmitted assignment is 75% of the allocated points. Fyi, I often do not get to grade and return revisions as quickly as I grade and return work on our “regular” schedule. I do not allow resubmitting of the Final Exam.

- **Policy on Late Assignments**: I expect that assignments will be turned in by the announced due dates and times. Assignments are to be submitted online using Oncourse, unless otherwise noted. I will accept assignments after the due date, but your grade will decrease by 10% of the allocated points for each day the assignment is late.

- **Policy on Computer Accidents**: Please make sure you save your work frequently and keep backup copies of your files when using a word processor. **Computer accidents, while very unfortunate, are not an acceptable excuse to avoid penalties for late work.**

- **Policy on Lost Assignments**: You should always keep a copy of every computer file or paper you turn in until your work is graded and you have received your course grade.

- **Attendance**: Attendance is required for all class sessions. Attendance is important for the following reasons. First, as a future teacher it is important to develop the sense of responsibility needed to meet your class every day. Second, activities, ideas, and concepts we work on in class are useful to you as a beginning teacher, and they cannot easily be built up through readings or someone else’s notes. Third, class includes important whole-class and small-group discussions, as well as laboratory hands-on activities; many of these activities cannot easily be made up individually if you miss class.

- **Calculation of Final Grades**: As noted above, the points for the course total to 400 points as follows:

  - Homework: 100 pts
  - TCM/MTMS Review: 20 pts
  - Midterm Exam: 90 pts
  - Project & Presentation: 100 pts
  - Final Exam: 90 pts

  The chart shows the point totals required to achieve specific final course grades, based on a typical 90%-80%-70%-60% scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points</th>
<th>Grade</th>
<th>Points</th>
<th>Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (95% +)</td>
<td>380</td>
<td>B- (80%)</td>
<td>320</td>
<td>D+ (67%)</td>
<td>268</td>
</tr>
<tr>
<td>A- (90%)</td>
<td>360</td>
<td>C+ (77%)</td>
<td>308</td>
<td>D (63%)</td>
<td>252</td>
</tr>
<tr>
<td>B+ (87%)</td>
<td>348</td>
<td>C (73%)</td>
<td>292</td>
<td>D- (60%)</td>
<td>240</td>
</tr>
<tr>
<td>B (83%)</td>
<td>332</td>
<td>C- (70%)</td>
<td>280</td>
<td>F</td>
<td>&lt;240</td>
</tr>
</tbody>
</table>

- **Attendance and Final Course Grades**: Students who are continually participating and have good attendance will have their point totals “rounded up” at the end of the semester if their score is a borderline case. For example, if someone who has earned 346 points has missed class only once, and participated regularly and professionally, their score will be rounded up to a B+. Someone with more than two absences who has earned 346 points will not have their score rounded up to a B+ and will earn a B. I do not round up scores in the A- range. Students who accrue unexcused absences will be notified via email. An alert form for excessive number of absences will be filed for students who accumulate more than 4 unexcused absences. Students who accumulate 6 or more unexcused absences will receive an FN (failure for nonattendance) grade. A doctor’s note stating the student was too ill to attend class is usually needed.
for excused absences; however, due to the swine flu university officials sometimes advise against unnecessarily exposing yourself and others by waiting in doctor’s offices. **Please inform me ahead of time if you have an unavoidable, planned absence.**

- **Tardiness:** For all the reasons given about attendance, please don’t be late to class. We have a short time together, and we will need to use all of it to accomplish the goals in the course. Tardiness not only is detrimental to the person who is late (who will miss important information and/or activities); it is disruptive to others. However, I know that occasionally life intervenes. **Please inform me if you know you have an unavoidable conflict and will be late to class.**

- **Cell phones, newspapers, etc.:** Please turn cell phones off during class. If you have an unusual circumstance, please inform me. Also, please do not bring newspapers and other outside reading materials to class—we have plenty to do together to keep us busy!

- **Academic Misconduct:** I hope there will be no need to worry about academic misconduct (cheating, plagiarism, etc.). All university policies concerning academic misconduct will be strictly followed and can be found at [http://dsa.indiana.edu/Code/Part_2pers.html](http://dsa.indiana.edu/Code/Part_2pers.html). Good information about plagiarism can be found at [http://education.indiana.edu/~frick/plagiarism/](http://education.indiana.edu/~frick/plagiarism/). **It is your responsibility to be familiar with these policies.**

**Final Notes**

I want to help you to become an excellent elementary or middle school teacher. Please feel free to contact me (email is best, or stop by my office, 3060) should you wish to discuss matters related to the course or to teaching in general. I am happy to discuss concepts and ideas, course assignments, as well as your grades on assignments. I look forward to working with you this semester!

**Other On-Line Resources**

Math is More (a website about mathematics education): [http://www.mathismore.net/](http://www.mathismore.net/)
Mathematicians’ Pictures: [http://www.mathematicianspictures.com/](http://www.mathematicianspictures.com/)
Website of women in mathematics: [http://www.agnesscott.edu/Lriddle/women/women.htm](http://www.agnesscott.edu/Lriddle/women/women.htm)
Mathematicians of the African Diaspora: [http://www.math.buffalo.edu/mad/00.INDEXmad.html](http://www.math.buffalo.edu/mad/00.INDEXmad.html)

**SOME RESOURCES FOR LESSON PLANNING:**

Illuminations, a website of lesson resources published by NCTM: [http://illuminations.nctm.org/](http://illuminations.nctm.org/)
MathSolutions lessons, a collection of lessons from the classroom:
A video library of mathematics lessons by Annenberg Media (grades K-4, 5-8):
  - [http://www.learner.org/resources/series32.html](http://www.learner.org/resources/series32.html)
  - [http://www.learner.org/resources/series33.html](http://www.learner.org/resources/series33.html)

Middle School mathematics curricula:
  - Connected Mathematics Project: [http://connectedmath.msu.edu/](http://connectedmath.msu.edu/)
  - Mathematics in Context: [http://www.showmecenter.missouri.edu/showme/mic.shtml](http://www.showmecenter.missouri.edu/showme/mic.shtml)

**INFORMATION FOR EDUCATORS:**

The Department of Education in Indiana: [http://www.doe.in.gov/communications/educators.html](http://www.doe.in.gov/communications/educators.html)
Indiana Professional Teaching Standards: [http://www.doe.in.gov/dps/standards/teacherindex.html](http://www.doe.in.gov/dps/standards/teacherindex.html)
The Mathematics Curriculum Center (information about state standards nationwide):
  - [http://www.mathcurriculumcenter.org/](http://www.mathcurriculumcenter.org/)