Math 353: Methods and Materials in the Teaching of Elementary School Mathematics
Fall Semester, 2006
TENTATIVE

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NOTE: Since this course is on WebCT assignments not outlined in this syllabus, along with clarifications or elaborations of the assignments listed herein, will usually be posted there. The WebCT calendar will also indicate dates we will be meeting at Graveraet Intermediate School and the activities there. Also, check your nmu.edu email account regularly for emails about the course.

Brief Description of the Course:

This is a course designed to acquaint prospective elementary teachers with contemporary methods and materials employed in the teaching of mathematics in the elementary school. We do this by exploring how children learn mathematics and how teachers design activities that help students achieve mathematical goals. My approach to teaching and learning mathematics is consistent with the *Michigan Curriculum Frameworks* and the National Council of Teachers of Mathematics' *Principles and Standards for Teaching Mathematics.*

A few minutes reflection will make it obvious that this course cannot teach you how to teach each and every topic in the K-8 math curriculum. The goal is to help you develop the ability to use various curricular materials to plan lessons that you will teach using appropriate methods. Naturally, I have views on appropriate teaching methods. These views are based on my experiences as an elementary and university teacher and as a researcher of teaching and learning. My beliefs about mathematics teaching align with those contained in the documents listed above and those of our text. *While you may disagree (and express that disagreement) with the methods advocated by the authors of these documents (and by me), to pass this course you must demonstrate that you understand the methods advocated.*

As this is a mathematics methods course, we will focus on **using mathematics in teaching**. There are two aspects involved in using mathematics in teaching and we will work on both: (a) having a robust sense of what it means to be proficient in mathematics, and (b) understanding and being able to use mathematics in ways needed for the work of teaching.

First, teachers need to appreciate what kinds of understanding and skill they would like their students to develop. So we ask: *What is involved in knowing and doing mathematics proficiently?* In reading and language arts, most teachers have a highly developed sense of what it means to be literate. But understanding what the analogue is in mathematics is more elusive. This course is designed to help you consider what it means to be mathematically capable. Here is a provisional definition: mathematical proficiency involves conceptual understanding, procedural fluency and skill, and the use of a variety of *mathematical practices*—skills, tools, and habits of mind and action—important to learning, doing, and using mathematics. Examples include using mathematical language, justifying claims and solutions, and developing and comparing

representations. Being mathematically proficient also includes confidence in one's own capacity and a sense of how to work productively.

Second, *teaching mathematics requires a great deal of specialized mathematical knowledge and reasoning*. Your own understanding, fluency, and comfort with mathematics will be important to your effectiveness as a teacher. Teaching depends on kinds of mathematical understanding and skill different from what it takes to do well in a math course as a student, or to be good at other jobs that require mathematics. In preparing, teachers need to determine the mathematical goals of activities, anticipate the varied ways students might respond, and prepare mathematically for what might happen as the lesson unfolds. Teachers must prepare good questions to ask and generate easier as well as harder versions of the problem, either as a back-up plan or as a way to focus or extend students' work. In order to hold high expectations of students, teachers need a keen sense of the complexity of particular mathematical ideas, and ways they can be scaffolded for students' learning.

We will work this semester on developing mathematical knowledge that is useful for teaching, and on learning to use mathematics as teachers. Our focus is the *mathematical content* of, for example, place value with whole numbers and decimals; the meanings of the operations of addition, subtraction, multiplication, and division; and procedures, place value meanings, and representations for whole and decimal number computation. Within topics, we will also work on *mathematical practices*, focusing particularly on the use of mathematical language, representations, and mathematical reasoning.

One semester is a short time to achieve the goals sketched above. If you work hard and attentively, you will learn to *do* mathematics teaching, as well as *analyze* it. You will develop skills of watching and listening that enable you to make sense of how others think mathematically and express themselves in multiple ways. You will develop practices that enable you to attend and respond to students' mathematical ideas and ways of thinking, and to plan, teach, and analyze mathematics lessons. You will elaborate your knowledge of some areas of mathematics in ways that ready that knowledge for the specific work of teaching it.

Working on these elements of mathematics teaching will enable you not only to get started, but also to go on learning from practice. One of my goals is for you to learn how to *learn teaching*. This involves learning how to study and examine practice, and to develop criteria for judging alternative instructional decisions and moves. In short, it means asking, exploring, and experimenting with the teaching of mathematics in school, *in ways that make children's ideas central to the work, and that preserve the mathematics with intellectual rigor and integrity.*

Prerequisite: **Admission to the methods phase of teacher education; at least a C in MA 150 and MA 151.**

Text: Van de Walle (2004). *Elementary and Middle School Mathematics*, 5th Edition. Longman

General Requirements:

- Professional behavior and attitude at all times:
- Show a genuine interest in learning the subject matter
- Demonstrate a sincere interest in the needs of elementary students
- Make every effort to be a valuable member of both our class and that of Graveraet
- Ask questions rather than pass judgments
- Have a spirit of cooperation with and support for your peers
- Use clear, grammatically and mathematically correct language both in discussions and in assignments
- Reflect excitement about teaching and learning
- Be *involved* in *our* class—not writing papers or studying for another class, not checking your calendar, etc. Students engaged in such activities will lose participation points.
- Appropriate Classroom Laptop Use: Although having a laptop in class opens up new learning possibilities for students, sometimes students utilize it in ways that are inappropriate. Refrain from instant messaging, e-mailing, surfing the Internet, playing games, writing papers, doing homework, etc. during class time. Acceptable uses include taking notes and working on assigned in-class activities, projects, and discussions that may be enhanced by laptop use. It is easy for your laptop to become a distraction to you and to those around you. Inappropriate uses will be noted (silently) and will result in loss of a grade in participation points. If you use your laptop during class, you will be expected to email me the notes you typed in class at the end of the class period (I will not ask for them but will keep records of those who do/do not.).
- Professional attire in the elementary school. At minimum, this means no shorts or blue jeans. Also, you will wear a name badge identifying you & your affiliation at all times in the schools (if not, you will lose participation points).
- Attendance at all class sessions. If you must miss a class for medical reasons, you are expected to provide an excuse from your medical provider.
- Participation will be an important part of your grade. This means that you must be on time and prepared (read assignments, prepared materials, etc.) for all class sessions. There will be times when we work individually, in small groups, or as a whole class. You will be expected to participate in all types of work to help develop understanding of teaching mathematics in the elementary school.

Assessment (further details will be provided in class as necessary, feel free to ask questions about any assignments—the earlier, the better)**.** When completing assignments please remember that I am not a mind reader. One of the roles of a teacher (me, in this case) is assessment. To assess your learning, I must be able to understand what you are thinking—your goal is to communicate to me what you are learning. This requires clarity and precision on your part.

- Attendance and participation. (75 pts)
- First class observation write-up (Due Tuesday, Sept. 26; 25 pts; see attached "First class observation questions")

The following two items will be completed in pairs (in one case, as a trio).

a. Interview write-up. Due Tuesday, Oct. 10. (25 pts; see attached "Interview Write-up" for details)

b. Develop a sequence of two lesson plans and teach (on successive Mondays) the small group of students that you interviewed. The plans will be based on what you learned in the interview. Grading will be on the plan not the actual teaching. (I will not be able to observe all groups teaching at once). One partner will be the lead teacher for the first lesson while the other mostly takes notes. You will reverse roles for the second lesson. The lesson plans are Due Tuesday, Oct. 24. I will grade them and return them in class the following week with (no doubt) many comments and suggestions. You will then have time to revise them before teaching the first lesson on Nov. 6. After teaching the first lesson, you may choose to revise the second LP for teaching on Nov 13. (You may not get all the way through the 1st LP and thus may have to incorporate part of the 1st into the second lesson. Alternatively, you may find the students understand much more (or much less) than you had expected and thus must revise the level somewhat.) **Note: your revised lesson plans are due the morning you teach—BEFORE you teach (so I can have a sense of your goals and intended pedagogy as I observe. This means printing an extra copy!).** (50 pts for original plan (revised LPs may result in improved scores); see attached "Lesson Plan Assignment" and "Interview-Teaching Activities" for details)

- Write a reflection on the teaching experience (i.e., on both lessons). (Due: Monday, Nov.20; 50 pts; see attached "Reflection on Teaching" for details)

- A sequence of three lesson plans. You will design the LPs as the first three days of an introduction of the K-8 mathematical concept and grade level of your choice. (Alternatively, you may design the 3rd - 5th lessons that would build off the two lesson sequence you teach your small group.) The lessons should build upon each other. In general, they will not be review or practice. The major goal is for you to demonstrate your understanding of the NCTM *Standards* and how the *Standards* might look in practice. You may want to design lessons that you will be able to use next semester when you student teach. (Due: Monday Nov. 27; 100 pts; see attached "Lesson Plan Assignment" for lesson plan requirements)

- You will be assigned readings from the text, preparation of materials, and various other out-of-class work. Questions may also arise from in-class activities and discussions. For some of these, you will write responses for homework. (5 or 10 pts ea—about 40-60 pts total)

- Three or four quizzes which will be given during the last portion of some class periods (so students who finish more quickly may leave). Questions will come from the assigned "Writing to Learn" or "For Discussion and Exploration" sections at the end of chapters in the text. (10 pts ea—30-40 pts total)

All written assignments are to be typed and submitted in hard copy form (not e-mailed). When you refer to a book, article, or other source, you <u>must</u> provide a <u>full</u> citation. When you use resources to generate ideas for lesson plans, etc., you must provide a citation. (If you are unsure what to include, look at the citations in our text. Web citations must be complete enough for me to easily access the same webpage.)

[Note: You may design any assignment to double-count with another course in the block—but it is *your* responsibility to make sure it meets the criteria of the instructors of both courses.]

All work completed for this class must be original. I expect each individual to think, write, reflect, question, and even sometimes struggle through the concepts presented in class, the text, or other readings. This is the only way you will learn and grow as a teacher. Students who commit academic misconduct, including plagiarizing work (copying or borrowing heavily from published materials) or copying or borrowing heavily from another student's work will fail this class. The university holds Academic Misconduct as a serious and punishable infraction.

Feel free to contact me (in my office, via e-mail, before/after class, etc.) when you feel you need help. I am happy to discuss assignments before they are due and have resources that I am willing to share (these may be especially helpful for the lessons you teach). Do **NOT** wait till the last minute (e.g., the day before you will teach or a major assignment is due) to seek help! Contact me if you do not understand the way I am grading assignments or if you are concerned about the grades you are receiving. If something becomes an issue, contact me immediately—do not wait till the last week of the semester.

Grades will be on the following scale:

A	93-100 percent	A-	90-92 percent		
B+	88-89 percent	B	83-87 percent	B-	80-82 percent
C+	77-79 percent	C	70-76 percent	C-	67-69 percent
D	60-66 percent	E	below 60 percent		

Note: If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Disability Services Office at 2001 C. B. Hedgcock (227-1700; TTY 227-1543). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state and University guidelines.

First Class Observation Questions

These are both an assignment and a set of guidelines for helping you learn from observations. They should help you focus and think like a student of teaching. You do not need to answer each specific question in each numbered item. However, I will be looking for a sense that you have thought carefully about each of the numbered items. An important part of your response is the evidence you use to support your statements.

1. What was the atmosphere in the classroom the moment you arrived? Did the students seem happy? Tense? Comfortable? Other? There may not be one atmosphere that you feel prevails over the whole room. The atmosphere may change across the time you are there. Try to note all this. Think about what **evidence** supports your observations—think of examples of behaviors that made you think this.
2. How would you describe the room? Is there evidence of mathematical activities? Note arrangement of student tables/desks. What is on the walls, chalkboard, etc? What posters, if any, are up? Etc. What role (if any) does the classroom environment seem to play in the students' learning?
3. What is your impression of the students' attitudes about math? Not all students may fit any particular category—try to get a sense of where *all* the students are attitudinally. What **evidence** supports your observations?
4. Consider the math lesson itself. What did the teacher do? What did the students do? {These should be more than "teach" & "learn." Did the teacher do examples? Did she give the students a "big" problem to work on in groups? Did she do all the talking? Did students talk—about math—with their peers or did they only answer the teacher's questions? Were their answers limited to one word or number or did they describe *how* they solved problems? Etc.) Think in terms of the NCTM Process Standards.
5. What was the mathematical content? Be more specific than, say, "Geometry" or even, "triangles." What math could the students learn? Think in terms of the NCTM Content Standards.
6. What did this experience start/continue you thinking about teaching?
7. What questions about teaching did the observation trigger for you? Did the teacher do anything that (surprised, pleased, disturbed, …) you? Why do you think s/he did that? What might s/he have done instead? (or) How might you have (re)acted in his/her place? Etc.

Interview-and Teaching Activities

We will visit one classroom at Graveraet Intermediate School for seven weeks on (sort of) successive Mondays starting on Sept. 18. About half of the class will be assigned to one of two classrooms. The first two weeks you will observe the students and, I hope, have some opportunity to interact with them. (You will be expected to participate in the manner the teacher specifies.) You might take the opportunity to think about which students you want to interview and teach. The third week, working in pairs (except one trio) you will interview a small group of students. The fourth through sixth weeks you will observe again (allowing you time to analyze the interview and design a pair of lessons). Each of the seventh and eighth weeks you will teach the same small group a lesson.

We will design the interview as a class. The teachers will give us some guidelines for the content of the interviews. Subsequent to each interview, based on what you learn from the interview, you will create a sequence of two lesson plans to teach in the seventh and eighth weeks.

You will work in pairs during this process (except one trio). One of you will take the lead for the interview. The other will observe, assist, and take notes that will help with the write-up and lesson planning. The two of you will then develop the two lessons you will teach the same small group. For the teaching, you should take turns being the "lead" teacher and being the recorder. This does not mean that the recorder cannot speak or help. Rather, to help you to learn from and write up the interview and teaching reflections, it will be helpful to have notes to refresh your memories. (It takes experience and practice to teach and later be able to recall which student said what. The recorder should attempt to get "quotes" that s/he thinks may offer insights into student thinking when you sit down to do the write-ups. Obviously, I do not expect you to be court recorders. Paraphrasing or "rough quotes" will be satisfactory.)

For both the teaching & interview, collect student work. Having a record of their written work may be helpful (though, often students may not write much and/or may try to erase their work or "wrong" answers. Try to encourage them to write their ideas; try to discourage them from erasing. You will turn in the student work with the respective write-ups.

Interview Write-up

Describe what happened. What did the students say, ask, do, try, etc? Give specific examples. Don't say, "They solved the problem." Tell *how* they did so. (Use the observer's notes to help you here.) Your focus here should be mostly on the students' *reasoning*, not so much on their success or failure at achieving the "right answer."

What did the students *understand*? This is not about what they were able to do (i.e., not, "They added 3x to both sides of the equation.") but about their understanding of *why* they did what they did. Again, give examples to justify your claims.

What did the students *not understand*? This is not about what they were unable to do (i.e., not, "They didn't know to add 3x to both sides of the equation.") but about their lack of understanding of *why* they did what they did. Again, give examples to justify your claims.

Based on what the students do/do not understand, what mathematical concepts should you teach? This should reflect what you have just written about the students' understanding. It should be about concepts that build upon what the students already understand and push them further. The concepts should be fairly specific—more so than, say, "Geometry" or "triangles." *What* do they already understand and what do they need to understand about triangles (that they do not already understand)? [As you design your lessons, you will think about *how* to help them understand these ideas. You may start addressing this issue of *how* here but it is not required.]

What did you learn about these students' relationship with mathematics and how they learn mathematics? What would have helped you to understand them better (besides more time with them)? How would this have improved your understanding?

What surprised you about this experience? Why?

What did this experience tell you about teaching mathematics? You should be thinking about the NCTM Process and Content Standards here. You might make some comparisons among: this experience; what the students normally experience in their classroom; what we do in our classroom; and what you perceive the NCTM and/or our author to be advocating.

Reflection on Teaching

Describe what happened. That is, walk through how the lesson actually went. E.g., what you did, what students did, etc. **Write this as if I was not there.** (After all, I will not see much of any of the lessons. Hopefully, the observer's notes will help.)
What do you think the students understood after your teaching that they did not before? I.e., what did the students learn?
Point out how the lesson differed from your lesson plan. Explain why it differed. This is not meant as a requirement to chastise yourself or trash your teaching. Rather, it is meant to think through carefully what happened & to learn from it. Changes from the plan may have been positive, after all. Remember: Lesson Plans are *plans.* As a teacher, you should be ready, willing, and able to adjust them as necessary—you should have *planned* alternative approaches to minimize surprises. The goal is not "to get through the lesson plan." The goal is "to help students develop mathematical understanding."
Critique the lesson—*critique*, not criticize. This means, analyze what happened: what students learned, what they did not (but was intended—reference your LP goals/objectives). What was it about the activity, manipulative, etc. that helped (or hindered) the students' learning? What were some positives, negatives, etc. Try to describe the experience from the **students'** perspective. (Teaching is about what students learn, not about how the teacher feels.)
If you were to teach the lesson again, what would you do? Go beyond (but you may include) the obvious & vague generalities (such as plan better, have more time, know students better, etc.). Be as specific as possible. How would such changes affect what students learn?
What would you have needed to know before the lesson for it to be even better than it was?
Any other comments or thoughts you think appropriate.

What did this experience tell you about teaching mathematics? You should be thinking about the NCTM Process and Content Standards here. You might make some comparisons among: this experience; what the students normally experience in their classroom; what we do in our classroom; and what you perceive the NCTM and/or our author to be advocating.

Lesson Plan Assignment

You are not expected to re-invent the wheel. Feel free to make use of resources for planning your lesson. However, provide references for resources you have used. Also, do **not** assume that, because a lesson plan is on the web (or anywhere else), it is necessarily a lesson plan that reflects the NCTM *Standards*—even if it claims to. Your goal is to *design* lessons that conform to the NCTM *Standards*. That is on what you will be graded. (Using references does NOT mean copying others' lesson plans. You may get *ideas* for lessons but the plan is to be designed by *you.)*

You may use any lesson plan format but it must include (& I must be able to identify) the following (order is not important):

- What are your mathematical goals?

  These should be **learning** goals—indicate what the students will (hopefully) **understand** after the lesson that they did not before. Learning goals refer to mathematical *concepts*; they are not what the students will *do*, they are not "able to do" goals. I.e., **not** "They will solve problems." **not** "They will measure shapes." **not** "They will be able to add two digit numbers." etc. "Students will be able to" goals may be included (in fact, are highly appropriate) but must not be the only type of goal you list. The "able to do" goals should help students meet the "understanding" goals. It would not hurt to look at the early parts of whatever chapter in our text relates to the content of your lesson.
- What will the teacher do? What will the teacher say? What will the teacher ask?
  - Don't say things like, "The teacher will explain the concept." This is completely generic & does not tell me what you are thinking.
  - Don't say, "We will discuss …" This too is generic & does not tell me what you are thinking. If you will have a discussion, give examples of what you would say/ask & what you would expect of students in response. Why are you discussing? What ideas do you intend the discussion to elicit?
  - Don't say, "I will ask the students if they understand." Think about yourself as a student when teachers ask this question; few students willingly admit they do not understand—esp. when the rest of the class answers that they do. However, it is important to be able to discern if the students *do* understand. How you do so should appear in the assessment section of the plan.
  - If, say, you lesson is about geometry, don't say, "I will present shapes." Be explicit about what shapes you will present, in what order, and why these shapes & that order. This is part of planning.
- What will the students do? (If the lesson has multiple parts, you should provide this information for each part.)
  - Will they be in their desks, at the board, writing, drawing, etc?
  - Will they be using manipulatives? How will they obtain them? How will they be introduced to them (if this is a first experience with them)?
  - Will they work individually? Pairs? Groups? Whole class?
- What is the mathematics available from the activity?

  What areas of math does the lesson address?—recall our in-class conversations about math in (a) our in-class activities, (b) various lessons the class has been

observing, & (c) the NCTM *Standards* & MI *Frameworks*. This is to be much more specific than, say, “Geometry.” or “Measurement.” or “Area & perimeter.”

- How will you assess your students?

  Make sure you include information on how you will assess students. This does NOT need to be a worksheet but you must be clear about how you will tell if students are meeting your learning goals (i.e., the assessment and goals should be related). [Completing a worksheet in & of itself is not such an indicator. I am sure many of you have done worksheets without having understood the concepts—I know I have.]
- If you will use any worksheets, <u>include them with the LP(s) you turn in</u>.
- Approximate time for <u>each part</u> of the lesson. How long will the intro take? Explaining the activity or problem? How long will you give students to work? Passing out materials? Etc.
- What materials do you need to have or prepare before the lesson?
- Any other info you deem important & necessary.

Feel free to utilize the Selection & Evaluation Criteria & the Problem Solving Goals in our text to help you plan.