EVERGREEN
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

Elementary Mathematics Methods
Winter Quarter 2009 (Wednesdays 4-7PM)
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COURSE OVERVIEW

"Research in mathematics education has consistently found that understanding and skills are best developed when students are allowed to wrestle with new ideas, to create and defend solutions to problems, and to participate in a mathematical community of learners."

~John Van De Walle

Much of the work we will engage in this quarter may differ from the way that you learned mathematics. Please approach this class with a curiosity about how children think mathematically and allow yourself to explore your role as a teacher in a mathematics classroom. This class will familiarize you with many instructional practices that are shown to *improve student learning.*

COURSE GOALS

- To strengthen your own understanding of mathematics and *how students learn* by doing mathematical tasks in a learning community *(Doing mathematics)*

- To actively engage in *writing to learn* by responding to given prompts *(Reflective journaling)*

- To discover that children bring important mathematical ideas to the classroom and that making sense of mathematics through discourse deepens their understanding *(Interviewing students)*

- To design learning opportunities for students that will draw out their ideas and build understanding *(Lesson planning)*

REQUIRED TEXT

Van de Walle, John A. (2007) *Elementary and Middle School Mathematics: Teaching Developmentally Sixth Edition.* Boston: Pearson Education.

ASSIGNMENT EXPECTATIONS

☐ This class is centered on class discussion, close careful observation of students and classrooms, and engaging in **math tasks**.

☐ Each week you will have a reading assignment along with selected reflection questions to respond to in an informal **journal** format.

☐ As a mid-term project, you will need to have a *student interview* formal paper submitted on February 4th

☐ As a final project, you will need to have a complete *lesson plan* submitted on March 4th

Week and Date Assigned	Reading Assignments (20- 30 pages weekly)	Writing To Learn Questions (5 prompts weekly)
WEEK 1 (1/7/09) page xvii *Van De Walle's Note To Students* Ch2 p12-20 *Exploring What It Means to Do Mathematics* Ch3 p22-34 *Developing Understanding in Mathematics*		**Opening Journal Entry in Class** p20 (#3 #4 #5) p34-35 (#4) For Discussion (#3)
WEEK 2 (1/14/09) Ch4 p37-59 *Teaching Through Problem Solving*		p59 (#1 #7 #8 #9) For Discussion (#1)
WEEK 3 (1/21/09) Ch9 p120-140 *Developing Early # Concepts & Number Sense*		p141 (#7 #8 #11 #12) For Discussion (#2)
WEEK 4 (1/28/09) Ch10 p143-162 *Developing Meaning for the Operations*		p163 (#1 #11 #12 #14) For Discussion (#1)
WEEK 5 (2/4/09) Ch11 p165-185 *Helping Children Master the Basic Facts* P107-109 *Calculators in the Mathematics Classroom*		p185 (Choose 4 from #1-14) p117 (#2)
WEEK 6 (2/11/09) Ch5 p61-75 *Planning for the Problem-Based Classroom* Ch6 p78-93 *Building Assessment Into Instruction*		p76 (#1 #5) p93 (#1 #6 #10)
WEEK 7 (2/18/09) Ch15 p259-290 *Algebraic Thinking :Generalizations, Patterns & Functions*		p291 (#3 #4 #5 #12) For Discussion (#1)
WEEK 8 (2/25/09) Ch17 p316-331 *Computation With Fractions*		p331-332 (#9 and choose 2-3 more)
WEEK 9 (3/4/09) Ch18 p 333-350 *Decimal & Percent Concepts and Decimal Computation*		p351 (#1 #4 #8) **Closing Journal Entries Below**
WEEK 10 (3/11/09) Last Day of Class No reading assignment	***Please bring a copy of these two responses with you to class** 1.What are the most important ideas that you learned in this class that you will take with you into your classroom? 2. Is there any new idea from this class that changed or shifted how you previously thought about math instruction? Please describe your new way of thinking about this topic.	

Conducting a Mathematics Interview (Due Week 5 – February 4, 2009)

✓ Interview <u>two</u> children (one at a time) using problems from the suggested list. Don't just pick haphazardly from the list of suggestions. Think about what you want to learn about the student and make appropriate selections.

✓ The problems should focus on **number sense.** They could be about problems that can be solved with whole number addition, subtraction, multiplication or division.

✓ Write up one interview using the guidelines below.

SOME IDEAS ABOUT TALKING TO STUDENTS

1. Tape record the conversation and keep all artifacts of the interview.

2. The problems that I provide are a guide. You are encouraged to adapt in order to make them appropriate for your students. You can also do follow-ups for the problems – just keep track of what you do and why, so you can explain it in your write-up.

3. You do not have to pose all of the problems to a child in one sitting.

4. Make sure the students have a variety of materials to use: paper and pencil, some type of unit counter and possibly some type of ten counters.

5. Before you start asking the student to solve a problem, let them know why you want to talk to them.
   > *"I'm really trying to learn more about how kids solve problems. I'm going to ask you a bunch of questions and I'll probably ask you to explain what you were thinking about so I can learn more. This is going to help me as a teacher. It's okay if you don't know how to do a problem – just say so and I bet we can work through it together. I'm not worried about whether you get the answer right. I'm really interested in how you think about the problem."*

   Telling them that you'd really like their help with an assignment you have for school often helps break the ice as well. Try to make them more comfortable. Some kids are not used to people asking them why they did something, and so they may think that if you ask them to explain, they must have done something wrong.

6. Make sure you let the students know they can solve the problem in any way that they wish. Try suggesting to the child that s/he talks aloud while solving the problem. Some children will not be comfortable doing that, and some will. If you cannot tell what the student did to solve the problem, follow up with <u>clarifying</u> questions like:
   > *Can you tell me how you solved the problem? What number did you start with? Can you show me what you were doing? Can you show me how you used your fingers?*

7. End the interview with the following kinds of questions: What do you think it means to be good at math? Who is good at math in your class? How do you know? How much do you like math? Why?

List of Possible Topics for the Student Interview

1. Choose one or more problems from the array of problem types (addition, subtraction) that we have talked about in class. Choose problems at different levels of difficulty to see what students do (e.g., result unknown vs. start unknown). Provide a context that you think is more meaningful for the student. Be thoughtful about the numbers you choose, and be prepared with more or less difficult numbers to modify the task.

   Claudia has 12 toy cars. How many more toy cars does she need to have 25 altogether?
   (or use 46 → 111)

2. Give the student digit cards 0–5. Ask the child to make the largest 2-digit number possible from those cards.

   Ask the child to make the largest 3-digit number possible from those cards.

   Ask the child to make the largest number possible from those cards.

3. Bundles Task (try with 1st graders and older)

   Have you ever seen one of these before? [show a ten bar] Do you know how many cubes there are here? [If child doesn't, have her/him count them with you.] Okay, so there are ten cubes in each of these ten bars. So how many do I have here? [put out 36]

   Record exactly how child counts 36 cubes.

   [*Cover 36 with a paper*] Now how many did you say there were here? 36? Okay. Now how many will I have if I add these? [*add 2 tens and 5 ones. Use your hand to indicate you want to include all of the cubes.*]

   Record exactly how child counts and figures out the sum. Do not remove paper unless child cannot solve the problem.

4. Basic Facts or Computational Questions (experiment with writing problems horizontally & vertically)

7 + 5	6 + 9	4 + 8
6 x 3	5 x 8	7 x 4
17 – 9	12 – 4	15 – 6
25 + 36	41 – 12	99 + 12
12 x 15	78 ÷ 15	36 x 3

5. Counting
   a. Can you count these? (put out 50 objects and document the count)
   b. Can you count out loud for me from 80 to 120?
   c. Can you count by tens for me from 80 to 130? From 23 to 123?
   d. How many do you see here? (use dot patterns, especially good for early grades)

6. Counting Collections is a simple task that can be repeated numerous times across the year and varied easily. The goal is for children to find and count a collection; it can be anything found around the room, bottle caps, raisins in a box, blocks, books on a shelf, etc. At first the task can simply be to count the collections. Variations can be included. Can they make a representation of their count on paper? How do their representations change over time? Can they find different ways of grouping or skip counting? Can they estimate their count first and then verify the estimate – how close are they? Do they get better across the year? Teachers can also sit with a group of children as they count and ask questions that help push the students' number sense. If a child has reached 20, the teacher could ask, "How many more do you need to get to 25?", "How many tens are there in 20?", or "What was the number before 19?" The advantage of using an open-ended task such as counting collections is that it allows children at different abilities to find an entry point, and at the same time, it allows the teacher to vary the task enough to challenge children as their abilities develop.

7. MULTIPLICATION AND DIVISION PROBLEMS TO SELECT FROM

- ✗ A pack of gum has 5 pieces. How many pieces of gum would you have altogether if you had 3 packs of gum?
- ✗ At a party, there were 18 M&Ms left to be shared fairly among 3 children. How many M&Ms would each child get?
- ✗ Ben has 24 pencils. They are packed 6 pencils to a box. How many boxes of pencils does he have?
- ✗ Twenty children are to be driven to the park. If each car had seat belts for only 3 children, how many cars would be needed to drive all 20 children to the park?
- ✗ Megan has 2 boxes of crayons. There are 10 crayons in each box. She also has 4 extra crayons. How many crayons does she have in all?
- ✗ There were 231 children signed up for an after school computer class. If 20 children can work in a classroom, how many classrooms are needed for all the children?
- ✗ The giraffe in the zoo is 3 times as tall as the kangaroo. The kangaroo is 6 feet tall. How tall is the giraffe?
- ✗ The first grade class has 4 boxes of doughnuts with 10 doughnuts in each box. They also have 17 individual doughnuts. How many doughnuts do they have altogether?

Interview Paper Write-Up (due Week 5 February 4, 2009)
Treat each flag ⚑ as a section of the write-up; please use subheadings

⚑ The Child
Describe the child you plan to interview. Include information you gather about the child (grade level, age, gender, race, and academic participation). What do you know about the child's level of understanding about the mathematics concept before the interview? (Use a pseudonym for the child.)

⚑ The Mathematics Concept
List the complete set of interview problems you asked the child with a brief overview of the child's responses. Explain why you chose these tasks. Include students' written work. This may include pictures, diagrams, symbolic notation. If students use manipulatives, draw what they did for us to see and follow.

⚑ Analysis and Reflection of the Child's Thinking
Analyze the problems and tasks that helped you learn the most about the *child's mathematical thinking*. State the task. Describe:
- What did the student do? (Use verbatim comments from the student.)
- What does the student understand?
- What questions would you like to ask the student now in retrospect?

Caution: **Describe the child's thinking** rather than making a broad claim such as "this student doesn't have number sense."

⚑ Reflecting on Your Questioning and Interviewing Skills
What is your assessment of your questioning? How well do you think you were able to elicit the students' ideas? What might you do differently next time? *Please use specific examples from your interview to answer these questions.*

Preparing a Complete Mathematics Lesson Plan (Due Week 9 – March 4, 2009)

☐ Chapter 5 & 6 contains useful information for planning your mathematics lesson. Specifically, pages 61-63 outlines the **nine steps** you need to go through as you plan a problem-based lesson.

☐ Please think of these nine steps as your **rough draft** to the **formal written lesson plan**. By going through these nine steps you will be making many of the critical decisions that will be outlined in your final lesson plan draft.

☐ You may choose to design a unit for your *placement grade level* using the curriculum your teacher uses. If you are endorsing in middle level or secondary mathematics, you may decide to prepare for the corresponding level or topics.

☐ You may also choose to prepare a mini-unit with other people (an investigation or lesson that lasts 2-3 consecutive days). It is very helpful to plan collaboratively because you can discuss the main idea and really clarify the goals. I would only recommend this option if your *placement grade level* matches or is close (one grade level up or down).

☐ Please include the following sections in your final lesson plan (see p.68 and examples p.72-75):

- Grade level
- Mathematical Goals (and corresponding Performance Expectation)
- Thinking About the Students
- Before the Lesson
    - Engaging, launching, connection
    - Outlining the Task
    - Establishing Expectations
- During the Lesson
- After the Lesson
- Assessment Notes
    - How will you know if they've reached the goal?
    - What will you do if they haven't met the goal?
    - What will you do if some students meet the goal early –how will you extend their learning?

☐ Formatting your final lesson plan:
- Please type your final lesson plan (and use about a size 12 font)