MAT.3420 – Teaching Mathematics in Grades PreK-6

Final Exam Outline

TEACHING & LEARNING MATHEMATICS IN A 21ST CENTURY CLASSROOM

- What are the students doing? (Five "process" standards, verbs of "doing" mathematics)
- What is the teacher doing? (Agendas of the 3-part lesson format)
- What are features of the classroom environment? (Classroom influences on learning, Mathematical community of learners)

- How would you describe what it means to "do mathematics"?
- Why is doing pencil-and-paper computation not "doing mathematics"?
- What features of a classroom environment are important for students to be engaged in doing mathematics?
- Explain the difference between teacher-centered instruction and student-centered instruction. Provide an example of each for the same content topic.
- Discuss the benefits of teaching with problems. Why is a problem-based approach a good way to reach all students in a diverse classroom?

Teaching Mathematics for Understanding (Instrumental & Relational Understanding; Conceptual, Procedural, & Conventional Knowledge)

- Describe conceptual knowledge of mathematics and procedural knowledge of mathematics. Provide examples of each.
- Explain the difference between knowing a procedure *without* a conceptual basis and knowing the same procedure *with* a conceptual basis. Provide a specific example. Which should come first: the conceptual or the procedure? Why?
- How can two people have different levels of understanding of the same idea without either having any really incorrect knowledge? Provide an example from mathematics. (Do not use instrumental knowledge of an algorithm in contrast with understanding an algorithm.)

Models

- How can a teacher use models incorrectly?

- Describe two types of physical models for base-ten concepts. Provides examples of each. What is the significance of the difference between these two models?

- Why would a second grade teacher feel that it is important to use groupable models (instead of pre-grouped models) for base-ten concepts at the beginning of the unit on place blue? That is, what idea or relationship is it that children at this age may have a better chance of constructing if using a groupable model instead of pre-grouped one? (Do not describe the model, only the value of one over the other for beginning-level concepts.)

- Give examples of three categories of fraction models. Why might it help a student in developing a new concept to use more than one physical model or representation?

MATHEMATICS TOPICS FOR THE ELEMENTARY SCHOOL CLASSROOM

- Make up a context and write some word problems illustrating join, separate, part-part-whole, and additive comparison situations.

- Make up multiplication word problems to illustrate the difference between equal groups and multiplicative comparison.

- Make up realistic measurement and partition division problems using the same numbers.

- How are traditional algorithms different from invented strategies? Provide examples. Explain the benefits of invented strategies over traditional algorithms?

- Illustrate non-algorithmic strategies for solving addition, subtraction, multiplication, and division given specific numbers.

- You are analyzing students' work and notice a student who says that $27 \div 5 = 17 \div 3$ is a "true" statement. He provides a reason: $27 \div 5 = 5R2$ and $17 \div 3 = 5R2$. Do you agree? Explain.

- Make up a word problem with a fraction as a divisor. Is your problem a measurement problem or a partition problem? Make up a second word problem with fractions of the other type (measurement or partition).

- If you were planning a short unit on measuring length for your kindergarten or first grade class, what might be the first activity that you would plan? Why?

- Show two ways an equilateral triangle below can be split into fourths. Show an incorrect way a student might think it shows fourths and explain why it is incorrect.

ON THE JOB…

- Explain to a colleague in your school (assuming she or he was not in this class) why you think it is important to teach through the use of problems.

- You are talking with teachers who believe in speed drill or timed tests as an effective method of helping students learn basic facts. Take a position either pro or con concerning speed drills and defend it briefly.

- A colleague in your school says, "Those alternative methods of computing may be important, but I think the students need to learn the 'regular' method first. Then we can teach them other methods after they have mastered the real way." From a teaching or pedagogical viewpoint, what is at least one reason that you should probably disagree with this person?

- In your fourth grade class, a student says his mom showed him an "easy" way to do multiplication. He shows the standard algorithm for two-digit numbers. How will you handle this?

- Suppose an older teacher in your school says, "There is no need to teach algebra to elementary school students." What will you say to her to help her understand what "algebraic thinking" means for elementary school students and which activities help students develop algebraic thinking. Why is algebraic thinking important for elementary school students?

Why not?

- Why is it not a good idea for students to believe that the validity (i.e. right or wrong) of their answers in mathematics is determined by the teacher or by the answer book?

- Why is saying, "It's easy! Let me help you" not a good idea? Discuss helping a student who is having difficulty solving a problem. What can you do?

- Give and briefly explain two reasons why the use of key words is not a suggested method for helping students with word problems.

- Why is drill (without the presence of fact strategies) not an effective method for developing fact mastery?

- Especially in this time when high-stakes tests are so important, why not just teach the standard algorithms for the operations and be done with it? Justify the time and effort required to develop invented strategies.