

Mathematics, Problem Solving, and Teaching Math 486, 4 Credits, Fall 2011

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or by email!

Course Rationale: Teaching Mathematics with Problems

Hiebert and others describe one of the essential principles for mathematics instruction as building understanding in mathematics through problems. Instruction ought to allow students to wonder, to inquire, to search for solutions, and to resolve incongruities. In a problem-based approach, students are expected to solve problems or make sense of mathematical situations. Ideally students need to explore problems, make conjectures, and draw generalizations about mathematics concepts and processes. Students can also make connections between mathematical ideas that are familiar to them by solving new problems in a variety of different settings. Although no one claims the existence of one correct way to teach, using good problems to plan instruction with the focus on student thinking and reasoning is one strategy that holds promise. Problem-based instruction is summarized by Gail Burrill as: “Good teachers foster an environment in which the students do the work!”

The educational outcomes of a problem-based approach to teaching mathematics are:

- Build new mathematical knowledge through solving problems.
- Solve problems that arise in mathematics and in other contexts.
- Apply and adapt a variety of appropriate strategies to solve problems.
- Monitor and reflect on process of mathematical problem solving.

Posing mathematical tasks in a way that promotes inquiry creates new classroom roles for instructors. Traditional practices offer a sense of accomplishment for teachers. Teachers explain, demonstrate, and monitor student practices. Students listen, observe, and practice skills and procedures that can be applied to specific kinds of problems. However, it is not just the amount of engagement with content that matters. The quality of the experience, the way in which students learn and think determines the usefulness of the educational experiences.

What are the goals and outcomes of this course?

Course Goals: Students in this course will

1. Be assessed for their knowledge in various mathematical content areas.
2. Provided with experiences in solving problems using many different strategies
3. Practice creating learning activities where problems are posed to engage their future students in meaningful mathematics.
4. Create assessment activities that give clear insight into students’ understanding of math concepts.

Learner Outcomes: Students will be able to:

- Solve problems in each of the content areas in the mathematics-teaching program.
 - Number and Operations
 - Algebra and Functions
 - Geometry and Measurement
 - Discrete Mathematics
 - Probability and Statistics
 - Calculus

- Solve problems that arise in mathematics and in other contexts.
- Apply and adapt a variety of appropriate strategies to solve problems.
- Integrate other disciplines, such as science, into the curriculum by making connections between curricular areas.
- Monitor and reflect on the processes of mathematical problem solving, communication, reasoning, representations, and making connections.
- Create lessons where problems are posed that engage students in specific mathematical concepts including the NCTM content standards of number and operations, algebra, geometry, measurement, data analysis and probability *and* the NCTM process standards of problem solving, reasoning and proof, communication, connections, and representation.
- Create assessment methods that clearly reveal their students' understanding of lesson outcomes.
- Reflect on the philosophical and pedagogical practices of teaching mathematics.

What do you need to do to show they have met the course outcomes?

Students will demonstrate their ability to meet the outcomes of this course through solving problems, reading, reflecting, and writing about problems posed. Writing in mathematics helps the writer consolidate their thinking because it requires the writer to reflect and clarify thoughts.

Communication is part of NCTM's call for mathematical literacy, which asserts that communication plays an essential role in assessing and developing understanding. Students will continue construction of the mathematics education electronic portfolio to meet the program standards including NMSA, NCATE, NCTM, CTL's Conceptual Framework, and Washington State Standards for secondary mathematics teachers.

Course Text and Equipment: Blackboard Course MATH 486, a TI 83+ graphing calculator, Internet access, and a Livetext account in order to add to the Teaching Middle School Mathematics Portfolio.

Assessment: You will show your ability to meet the performance outcomes by completing the following assessments. More detail on some of these will be provided at the appropriate time.

- 1. Problem–Creation and Presentation Assignment:** You will collaborate with your peers to create two engaging problems aligned with specific content and process standards. You will present your problems to the class and serve as facilitators during the class period. This is a small–group grade. (40 points each – 80 points total)
- 2. Written Assessments:** You will write six concise papers, each relating either an item in **1**, an item from another class you took, or the item created in **3** to appropriate content standards. These papers will allow you to review the work of peers and reflect upon your own knowledge and ability to explain content standards aligned with NCTM mathematics standards. This is an individual grade. (15 points each – 90 points)
- 3. Assessment Creation Assignment:** The details of this assignment will be given at the appropriate time. This may be either an individual or small-group grade, depending upon time constraints and content. (40 points)
- 4. Mathematics Content Exercise Sets:** Six sets of exercises covering the basic concepts and procedures from each of the six mathematical content areas (listed under learner outcomes) will be given. These are take-home assignments and must be completed by the due date. No late work will be accepted. See the assignment directions for more details. This is an individual grade. (20 points each – 120 points total)
- 5. Mathematics Content Quizzes:** Six in–class quizzes, each covering the basic concepts and procedures from exercise sets in **3**, will be given. This is an individual grade. There are some sample quizzes on Blackboard to aid you in studying and the items in **4** are also invaluable. Make-

up quizzes are given at the discretion of the instructor. (20 points each – 120 points total)

6. Portfolio: The final in this course is to complete the Content and Process Standard section of the Livetext portfolio and write the corresponding reflections. **Item 2** above will be 6 of these reflections, but you will have to provide a newly written reflection (addressing 5 process standards for 75 points total) as described in Step 3 of the Livetext portfolio directions as part of this 125 point score. The portfolio sections must be complete by Dec. 2 at 5 pm. For each day late, 20 points will be deducted from the score. This is an individual grade. (125 points). Start by reading the first question and statements that are in its folder. After you thought about the writing prompt write a response using the guidelines outlined in the folder. The Livetext portfolio must be completed to receive a grade for the course.

Grades: total points = 575 from above

In order to teach others, you must have a good command of the subject. If you do not understand the material well enough to teach it, both you and your students will suffer. Therefore, your work in this course must be assigned a grade.

93- 100% A	90- 92% A-	87- 89% B+	83- 86% B	80- 82% B-	77- 79% C+	73- 76% C	70- 72% C-	67- 69% D+	63- 66% D	60- 62% D-	<60% F
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Schedule/Rules: If you miss class, it is your responsibility to find out what was covered announced or assigned by checking. Blackboard can help you to find any handouts/materials you will need. In case of emergencies, it is your responsibility to contact the instructor as soon as possible. Any changes in deadlines due to emergencies, except for the firm dates of the Exercise Sets, are left up to the discretion of the instructor.

How to succeed: Take the responsibility for your own achievement of these performance objectives. Use the activities, assignments, assessments, and people, such as the instructor and peers, to insure that you understand the mathematical teaching concepts and can demonstrate this understanding in the various assessments, especially the final portfolio.

Additional Note

Students with disabilities who wish to set up academic adjustments in this class should give me a copy of their “Confirmation of Eligibility for Academic Adjustments” from the Disability Support Services Office as soon as possible so we can discuss how the approved adjustments will be implemented in this class. Students without this form should contact the Disability Support Services Office, Bouillon 205, or dssreceipt@cwu.edu or 963–2171.

Good Luck in this course! I hope you find it enjoyable. Never hesitate to talk to me if you have any problems.

Don't skip class! We meet only 2 times per week for 4 credits. If you plan to become a successful teacher, you must know the material exceptionally well!