MATH 486

Mathematics, Problem Solving, and Teaching (4 credits)

Fall 2010

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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 why things are, 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 in its simplest is summarized by Gail Burrill as; Good teachers foster an environment in which the students do the work!

The educational outcomes of a problematic 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 kind 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.

Course Description: What are the goals and outcomes of this course?

Course Goals

1. Assess the student's mathematical knowledge in mathematical content areas.
2. Give student experiences with solving problems using many different strategies
3. Create learning activities were problems are posed to engage students in meaningful mathematics.
4. Create assessment activities that give clear insight into students' understanding of math concepts.

Learner Outcomes--Student 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.
- Monitor and reflect on process of mathematical problem solving, communication, reasoning, representations, and making connections.
- Create lessons were problems are posed that engage students in specific mathematical concepts.
- Create assessment methods that clearly reveal their students understanding of lessons outcomes.
- Reflect on the philosophical and pedagogical practices of teaching mathematics.

What do the students 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 consolidates their thinking because it requires the writer to reflect and clarify their 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 all the program, 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, access to the internet to create wiki-pages, and Livetext account add to the Teaching Middle School Mathematics Portfolio.

Assessment: Students will show their ability to meet the performance outcomes by completing the following assessments:

- Students will be create teaching examples on a wiki-page aligned with middle level mathematics teaching content standard (30 points).
- Students will be create teaching examples on a wiki-page aligned with middle level mathematics teaching process standard (30 points).
- Teaching papers may require a lesson plans and at least one of these lessons will be taught in a local classroom (20 points).
- Student will be required to review peers explanations and reflect on their own knowledge and ability to explain content and process standards aligned with middle level mathematics standard (20 points each).
- Six sets of exercises covering the basic concepts and procedures from each of the six mathematical content areas will be given. These are take-home assignments and must be completed and explained in writing by the next class meeting (10 points). Each student will be asked to explain two of the problems on these take-home quizzes (10 points). An on-line quiz must be taken until 80% or better is achieved before the in class quiz is given (10 points).
- Six in class quizzes worth 20 points each covering the basic concepts and procedures from each of the content areas will be given.
- The final in this course is to complete the Content and Process Standard section of the livetext portfolio and write the corresponding reflections (100 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.

Grading--Grades will be determined by the following percents:
93-100% = A, 90-93% = A-, 87-90% = B+, 83-87% = B, 80-83% = B- , 77-80% = C+, 73-77% = C, 70-73% = C-, 67-70% = D+, 63-67% = D, 60-63%, 0-60% = F.

Schedule/Rules: The instructor has a class schedule on Blackboard. If a student misses class, it is their responsibility to find out what was covered announced or assigned by checking Blackboard. In case of emergencies, it is their responsibility to contact the instructor as soon as possible. If a course deadline was missed, assessment alternatives 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 to insure that you understand the mathematical teaching concepts and can demonstrated this understanding in the performance objectives.

"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 meet to discuss how the approved adjustments will be implemented in this class. Students with disabilities without this form should contact the Disability Support Services Office, Bouillon 205 or dssrecept@cwu.edu or 963-2171 immediately."