Syllabus

Spring, 2010

Course: Math 255, *Mathematics for Elementary and Middle School Teachers*, 4 credits

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MC 525
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Hours: Daily 8am – 10am

Final Exam: Tuesday 11th May 9:50am – 11:50am

Prerequisites: Grade of C or better in Math 155 or permission of instructor

Text: *Mathematics for Elementary Teachers*, 4th ed., by Tom Bassarear, Houghton Mifflin, 2007.
(This text is used in Math 355 also)
Activity Packet

Description

This course is designed to introduce the preservice K-9 teacher with ideas, techniques and approaches to teaching mathematics. Emphasis is on problem solving and problem posing, use of manipulatives and children's literature, and understanding children's thinking. The math content areas are the arithmetic operations and number theory.

The Viterbo University Teacher Education Program has adopted a Teacher As Reflective Decision Maker Model and the Wisconsin Standards For Teacher Development and Licensure, also known as INTASC (Interstate New Teacher Assessment and Support Consortium) Standards. Each course is designed to contribute to the development of one or more of the INTASC Standards. (These standards can be found at http://www.dpi.state.wi.us/dpi/standards/index.html)

Franciscan values, Viterbo core abilities and the liberal studies are the basis of the Viterbo education experience. Focus of every professional education course is on the learning of the PK-12 pupil. Viterbo education courses infuse constructivist practices, use of technology, PK-12 collaboration, awareness of diversity, traditional and authentic assessment, teacher work sample components, and real-world experiences into the preparation of the preservice teacher.

Wisconsin Standards for Teacher Development and Licensure (INTASC)
Standards 1,2,3,4,6,9
Wisconsin Model Academic Standards
A, B, F
Wisconsin Content Guidelines
1,2,3,4,5,6,7,8,9,10
Viterbo Core Abilities
Thinking, Communication, Cultural Sensitivity

Resources: The following materials are on reserve in the library:

Sample solutions to investigations
Various books on problem solving

Methodology: Lecture, class discussion, small group work, student presentations.

Goals (INTASC 1)

To help students:

1. learn to value mathematics;
2. learn to reason mathematically;
3. learn to communicate mathematically;
4. become confident in their mathematical ability; and
5. become problem solvers and posers.

Objectives

Problem Solving (INTASC 1,2,3)

Upon successful completion of this course, the student will be able to:

- build new mathematical knowledge through problem solving
- solve problems that arise in mathematics
- apply and adapt a variety of appropriate strategies to solve problems
- monitor and reflect on the process of mathematical problem solving

Reasoning and Proof (INTASC 1,4)

Upon successful completion of this course, the student will be able to:

- recognize reasoning and proof as fundamental aspects of mathematics
- make and investigate mathematical conjecture
- develop and evaluate mathematical arguments and proofs
- select and use various types of reasoning and methods of proof

Communication (INTASC 6)

Upon successful completion of this course, the student will be able to:

- organize and consolidate his or her mathematical thinking through communication
- communicate his or her mathematical thinking coherently and clearly to peers, teachers, and others
- analyze and evaluate the mathematical thinking and strategies of others
- use the language of mathematics to express mathematical ideas precisely
- create and use representations to organize, record, and communicate mathematical ideas

Connections (INTASC 1,4)

Upon successful completion of this course, the student will be able to:

- recognize and use connections among mathematical ideas
- understand how mathematical ideas interconnect and build on one another to produce a coherent whole
- recognize and apply mathematics in contexts outside of mathematics

Student Responsibilities

One cannot benefit from or contribute to a class discussion or activity unless one is physically present (this a necessary condition, not a sufficient one). Attendance is required. Call me (796-3658) if you will not be in class. A valid excuse is necessary to miss class. Unexcused absences may lower your grade for the course.

Assigned readings of the texts and handouts need to be done if meaningful discussion can occur. As teachers you should appreciate the importance of class participation. Your active participation makes the course go. *Math is not a spectator sport*. Assigned problems and textbook exercises are ways for you to develop problem solving skills and reflect on your learning. Do the problems when they are assigned.

Content

I. Foundations for Learning Mathematics
- A. Getting Comfortable with Mathematics
- B. Problem Solving and Reasoning
- C. Patterns
- D. Communication
- E. Connections
- F. Putting It All Together

II. Fundamental concepts
- A. Sets
- B. Functions
- C. Numeration

III. The Four Operations of Arithmetic
- A. Addition and Subtraction
- B. Multiplication and Division
- C. Mental Arithmetic and Estimation

IV. Number Theory
- A. Divisibility and Related Concepts
- B. Primes and Composites
- C. Greatest Common Factor and Least Common Multiple

V. Extending the Number System - Integers <if time permits>
- A. Operations With Integers

Requirements

- Two math activities, one for K-2, the other for grades 3-5. (see handout)
- Learning journal from class (see handout)
- Three exams
- Four summaries of articles in **professional journals** on the following topics (see handout):
  Problem Solving , Addition or Subtraction of Whole Numbers, Multiplication or Division of Whole Numbers, Number Theory.
  [Some good sources are *Arithmetic Teacher*, *Teaching Children Mathematics*, *Mathematics Teaching in the Middle School*, *AIMS*, and *School Science and Mathematics*.]
- Three investigations (see handout)

Evaluation

	Points	GRADING
Three tests (200 points each)	300	A: 90% - 100%
Investigations	100	B: 80% - 89%
Homework	100	C: 70% - 79%
Labs	100	D: 60% - 69%
total	600	F: Below 60%

A Note to You

This is a course for prospective elementary and middle school teachers about how children learn mathematics and how to create positive, developmentally- appropriate mathematics instruction. Since we have all gone to elementary school, we have learned and "know" the mathematics which will be addressed in this course; in fact, we may know it so well that we have forgotten what it was like to ever not know it. Or, because of inadequate past instruction, we may feel we "know" certain mathematical topics but have never really understood them, or we may even dislike the subject. If this is the case, consider this course an opportunity to break the cycle of negative, disempowering mathematics teaching. Mathematics can be an intellectual adventure, a powerful tool, and a creative experience for children. As a teacher, you can make it so.

Some of you may have had mathematics courses that were based on the transmission, or absorption, view of teaching and learning. In this view, students passively "absorb" mathematical structures invented by others and recorded in texts or known by authoritative adults. Teaching consists of transmitting sets of established facts, skills, and concepts to students. I do not accept this view. I am a *constructivist*. Constructivists believe that knowledge is actively created or invented by the person, not passively received from the environment. No one true reality exists, only individual interpretations of the world. These interpretations are shaped by experience and social interactions. Thus, learning mathematics should be thought of as a process, of adapting to and organizing one's quantitative world, not discovering preexisting ideas imposed by others. It is one way to make sense of the world.

Consequently, I have three goals when I teach. The *first* is to help you develop mathematical structures that are more complex, abstract, and powerful than the ones you currently possess so that you will be capable of solving a wide variety of meaningful problems. The *second* is to help you become autonomous and self- motivated in your mathematical activities. You will not "get" mathematics from me but from your own explorations, thinking, reflecting, and participation in discussions. As independent students you will see your responsibility is to make sense of, and communicate about, mathematics. Charles Schultz, creator of "Peanuts", compared people to multispeed bikes and noted that "most of us have gears we do not use." Hopefully you will see mathematics as an open-ended, creative activity and not a rigid collection of recipes. And the *last* is to help you become a skeptical student who looks for evidence, example, counterexample and proof, not simply because school exercises demand it, but because of an internalized compulsion to know and to understand.

I want to help you learn to do something different from and better than what you have experienced as pupils in previous mathematics classes A mathematics methods class is about mathematics, about children as learners of mathematics, about how mathematics can be learned and taught, and about how classrooms can be environments for learning mathematics. It's a class where the students learn about learning mathematics while they themselves are learning mathematics.

As a teacher I have come to realize that when I teach mathematics I teach not only the underlying mathematical structures but I am also teaching my students how to develop their cognition, how to see the world through a set of quantitative lenses which I believe provide a powerful way of making sense of the world, how to reflect on those lenses to create more and more powerful lenses and how to appreciate the role these lenses play in the development of their understanding.

So I ask your help in establishing a mathematical community where one uses logic and mathematical evidence as verification rather than the teacher, where mathematical reasoning replaces the memorization of procedures, and where conjecturing, inventing, and problem solving are encouraged and supported.

You may find this experience frustrating at times. Persevere! Eventually I hope you will own personally the mathematical ideas you once knew unthinkingly or only peripherally (and sometimes anxiously). I want you to become competent and confident using mathematical ideas and techniques. I want you to be ready to learn how to get other persons actively involved in problem solving. To nurture a mathematical idea in the mind of a child might be easier if it first thrived in the mind of the child's teacher.