

Fall, 2008

Course: Math 355, *Mathematics for Elementary and Middle School Teachers*, 4 credits

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MC 525

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Hours: Daily 8-10

Prerequisites: Grade of C or better in Math 255

Text: *Mathematics for Elementary Teachers*, 4th ed., by Tom Bassarear, Houghton Mifflin, 2007.

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 geometry and rational numbers.

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 1,2,3,4,6,8,9

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: You may qualify for free tutoring in the Learning Center.

The following materials are on reserve in the Todd Wehr 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. Geometry
 - A. Spatial Reasoning
 - B. Van Hiele levels
 - C. Two-dimensional geometry
 - D. Three-dimensional geometry
 - E. Translations, reflections and rotations
 - F. Symmetry
- II. Measurement
 - A. Length
 - B. Area
 - C. Volume
- III. Rational Numbers
 - A. Models
 - B. Ordering
 - C. Renaming
 - D. Addition and subtraction
 - E. Multiplication and division
 - F. Decimals

Requirements

- Two math activities, one on geometry and one on fractions (see handout)
- Three investigations
- Learning journal from class
- Three exams
- Four summaries of articles in **professional journals** on the following topics:

Geometry , Assessment, Fractions, and Equity

[Some good sources are *Arithmetic Teacher*, *Teaching Children Mathematics*, *Mathematics Teaching in the Middle School*, *AIMS*, and *School Science and Mathematics*.] (see handout)

Completion of a minimum of 10 hours of field experience working with an elementary student on mathematics (see handout)

A clinical journal of your sessions with your elementary student [**NOTE: YOU MUST MEET WITH YOUR STUDENT AND FULFILL THIS REQUIREMENT IN ORDER TO PASS THIS COURSE.**]

Evaluation

Points

Tests (200 points each) 600

Investigations 200

Clinical journal 80

Learning journal 60

Readings 40

Math Activities 20

total 1000

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 is 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. Quite simply, this is not what mathematics is. Mathematics is about discovery and understanding. You have probably come to the conclusion that math is about memorizing and applying formulae. This is unfortunate, and has happened because most teachers have a very natural concern that their students succeed on standardized tests. They are more concerned that their students pass the exam than that they do Mathematics. Test success is, after all, one way in which the teacher's own success is measured. However, such formulae are really only an end product of Mathematics, not the subject itself. Imagine a music class in which the students just put CDs into a player or an art class in which the students just cut pictures out of books and magazines and stuck them to the wall. This is precisely what happens in all too many Mathematics classes.

This does not mean that the math class has no place for formulae, only that these formulae should be mnemonics to help the students remember what they have already discovered and build on earlier understanding and discovery to progress further.

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 "get" mathematics not only from me but also 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.

In training a child to activity of thought, above all things we must beware of what I will call "inert ideas" - that is to say, ideas that are merely received into the mind without being utilized, or tested, or thrown into fresh combinations . . . Education with inert ideas is not only useless: it is, above all things, harmful. Except at rare intervals of intellectual ferment, education in the past has been radically infected with inert ideas . . . Let us now ask how in our system of education we are to guard against this mental dryrot. We enunciate two educational commandments, "Do not teach too many subjects," and again, "What you teach, teach thoroughly." . . . Let the main ideas which are introduced into a child's education be few and important, and let them be thrown into every combination possible. The child should make them his own, and should understand their application here and now in the circumstances of his actual life. From the very beginning of his education, the child should experience the joy of discovery.

(Alfred North Whitehead, *The Aims of Education*)

BIBLIOGRAPHY

- Adding It Up. Helping Children Learn Mathematics*, National Research Council, 2001.
- Baratta-Lorton, Mary, *Mathematics Their Way* Addison Wesley, 1976.
- Bay-Williams, Jennifer and Sherri Martinie, *Math and Literature, Grades 6-8*, Math Solutions, 2004.
- Biggs, Edith E. and James R. MacLean, *Freedom to Learn*, Addison Wesley, 1969.
- Bresser, Rusty, *Math and Literature, Grades 4-6*, 2nd edition, Math Solutions, 2004.
- Bresser, Rusty and Carn Holtzman, *Developing Number Sense*, Math Solutions, 1999.
- Brown, Stephen I. and Marion I. Walter, *The Art of Problem Posing*, 2nd ed., Lawrence Erlbaum, 1990.
- Burns, Marilyn, *About Teaching Mathematics*, Math Solutions, 2000.
- _____. *Math By All Means: Place Value, Grade 2*, Math Solutions, 1994.
- _____. *A Collection of Math Lessons, Grades 6 through 8*, Math Solutions, 1990
- _____. *MATH - Facing an American Phobia*, Math Solutions, 1998.
- A Call for Change*, Recommendations for the Mathematical Preparation of Teachers of Mathematics, Mathematical Association of America, 1991.
- Chapin, Suzanne H. and Art Johnson, *Math Matters. Grades K-6. Understanding the Mathematics You Teach*, Math Solutions, 2000.
- Chapin, Suzanne et al, Classroom Discussions. *Using Math Talk to Help Students Learn, Grades 1-6*, Math Solutions, 2003.
- Connolly, Paul and Teresa Vilardi (editors), *Writing to Learn Mathematics and Science*, Teacher's College Press, 1989.
- Countryman, Joan, *Writing to Learn Mathematics*, Heinemann, 1992.
- Crosswhite, F. Joe and Robert Reys, *Organizing for Mathematics Instruction, 1972 yearbook*, NCTM, 1972.
- Dahlke, Richard and Roger Verhey, *What Expert Teachers Say About Teaching Mathematics, Grades K-8*, Dale Seymour Publications, 1986.
- Davidson, Neil (editor), *Cooperative Learning in Mathematics: A Handbook for Teachers*, Addison-Wesley, 1990.
- Davis, Robert B., *Learning Mathematics*, Ablex, 1984.
- Developing Mathematical Reasoning in Grades K-12, 1999 Yearbook*, NCTM, 1999.
- Driscoll, Mark and Here Confrey (editors), *Teaching Mathematics: Strategies that Work*, Northeast Regional Exchange, Inc. 1985.

- EDThoughts, *What We Know About Mathematics and Learning*, McREL, 2004.
- Fennema, Elizabeth and Thomas Carpenter, *Cognitively Guided Instruction, Program Implementation Guide*, Wisconsin Center for Educational Research, 1990.
- Fosnot, Catherine Twomey and Maarten Dolk, *Young Mathematicians at Work. Constructing Multiplication and Division*, Heinemann, 2001.
- Grouws, Douglas A. et.al., (editors), *Perspectives on Research for Effective Mathematics Teaching*, NCTM, 1988.
- Heuser, Daniel, *Reworking the Workshop. Math and Science Reform in the Primary Grades*, Heinemann, 2002.
- Hiebert, James et al, *Making Sense - Teaching and Learning Mathematics with Understanding*, Heinemann, 1997.
- Johnson, David R., *Every Minute Counts*, Dale Seymour Publications, 1982.
- _____. *Making Minutes Count Even More*, Dale Seymour Publications, 1986.
- Kohn, Alfie, *The Schools Our Children Deserve*, Houghton Mifflin, 1999.
- _____, *What to Look for in a Classroom*, Josey Bass, 1998.
- Krulik, Stephen and Robert E. Reys, *Problem Solving in School Mathematics*, 1980 yearbook, NCTM, 1980.
- Kuhs, Therese M., *Measure for Measure - Using Portfolios in K-8 Mathematics*, Heinemann, 1997.
- Kulm, Gerald (editor), *Assessing Higher Order Thinking in Mathematics*, American Association for the Advancement of Science, 1990.
- Lawrence, Ann and Charlie Hennessy, *Lessons for Algebraic Thinking, Grades 6-8*, Math Solutions, 2002.
- Leutinger, Larry, ed., *Mathematics in the Middle*, NCTM, 1998.
- Ma, Liping, *Knowing and Teaching Elementary Mathematics*, Lawrence Erlbaum, 1999.
- Math Talk*, The Mathematical Association (U.K.), Heinemann, 1987.
- Mills, Heidi et al, *Mathematics in the Making - Authoring Ideas in Primary Classrooms*, Heinemann, 1996
- O'Brien, Thomas C., *Toward the 21st Century in Mathematics Education*, Teacher Center Project, Southern Illinois University at Edwardsville, 1982.
- Ohanian, Susan, *One Size Fits Few*, Heinemann, 1999.
- Ohanian, Susan, *Day By Day Math - Activities for Grades 3 - 6*, Math Solutions, 2000.
- Paulos, John Allen, *Innumeracy*, Hill and Wang, 1988.
- Polonsky, Lydia et al, *Math for the Very Young*, John Wiley, 1995.
- Polya, G., *Mathematical Discovery Vols I and II*, John Wiley, 1965.
- Principles and Standards for School Mathematics*, National Council of Teachers of Mathematics, 2000.
- Raphel, Annette, *Math Homework that Counts - Grades 4 - 6*, Math Solutions, 2000.
- Resnick, Lauren and Leopold Klopfer (editors), *Toward the Thinking Curriculum: Current Cognitive Research*, 1989 ASCD Yearbook, Association for Supervision and Curriculum Development, 1989.
- Schoen, Harold L. and Marilyn J. Zweng, *Estimation and Mental Computation, 1986 Yearbook*, NCTM, 1986.
- Schoenfeld, Alan H. *Problem Solving in the Mathematics Curriculum*, MAA Notes Numbered, Mathematical Association of America, 1983.
- _____. *Cognitive Science and Mathematics Education*, Lawrence Erlbaum Associates, 1987.
- _____. *Mathematical Problem Solving*, Academic Press, 1985.
- Sheffield, Stephanie and Kathleen Gallagher, *Math and Nonfiction, Grades 3-5*, Math Solutions, 2004.
- Silver, Edward A., et.al., *Thinking Through Mathematics*, The College Board, 1990.
- Skinner, Penny, *It All Adds Up! Engaging 8-to-12-year-olds in Mathematical Investigations*, Math Solutions, 1999.
- Steen, Lynn Arthur and Donald J. Albers (editors), *Teaching Teachers, Teaching Students*, Birkhauser, 1981.
- Stenmark, Jean Kerr, et.al., *Assessment Alternatives in Mathematics Project EQUALS*, 1989.
- _____. *Family Math*, Lawrence Hall of Science, 1986.
- Sterrett, Andrew (editor), *Using Writing to Teach Mathematics*, MAA Notes Number 16, Mathematical Association of America.
- Stigler, James W. and James Hiebert, *The Teaching Gap*, Free Press, 1999.
- Suydam, Marilyn N. and Robert E. Reys, *Developing Computational Skills, 1978 Yearbook*, NCTM, 1978.
- The Teaching and Learning of Algorithms in School Mathematics, 1998 Yearbook*, NCTM, 1998.

Teaching and Learning Mathematics in the 1990s, 1990 Yearbook, NCTM, 1990.

Trafton, Paul R. and Albert P. Shulte, *New Directions for Elementary School Mathematics*, 1989 yearbook, NCTM, 1989.

Tsuruda, Gary, *Putting It Together*, Heinemann, 1994.

Von rotz, Leyani, and Marilyn Burns, *Lessons for Algebraic Thinking, Grades K-2*, Math Solutions, 2002.

Wisconsin Model Academic Standards in Mathematics, Wisconsin DPI, 1998.

Zaslavsky, Claudia, *The Multicultural Math Classroom*, Heinemann, 1996.

Americans with Disabilities Act

If you are a person with a disability and require any auxiliary or other accommodations for this class, please see me and Wayne Wojciechowski, the Americans With Disabilities Act Coordinator (MC 335 <796- 3085>) within ten days to discuss your accommodation needs.

It is somewhat surprising and discouraging how little attention has been paid to the intimate nature of teaching and school learning in the debates on education that have raged over the past decade. These debates have been so focused on performance and standards that they have mostly overlooked the means by which teachers and pupils alike go about their business in real-life classrooms - how teachers teach and how pupils learn.

Jerome Bruner

THIS SPACE FOR RENT