

**METHODS OF INSTRUCTION IN THE
MATHEMATICS CURRICULUM FOR THE ELEMENTARY SCHOOL**

MATH 402, Section P3, Fall 2009
Du Sable Hall 306 (Mathematics Education Lab)

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Tuesday 12:00-1:00 pm, Thursday 3:00-4:00 pm,

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Course Goals

In this course, you will explore the teaching of mathematics, investigating both what to teach and how to teach it. The purpose of this course is to begin inquiry into mathematics teaching and learning that will guide you in your first teaching experiences and give you tools that will enable you to continue to inquire and learn as part of your work as a teacher. Current national reforms in mathematics education recommend that elementary teachers think in new ways about the content of their instruction (what to teach) and pedagogy (how to teach). This course is intended to *launch you* as a learner and teacher of mathematics in ways that correlate with these reforms.

In this course, you will explore how students learn mathematics and what is meant by deep understanding of mathematics. You will learn how to teach mathematics so that learners see relationships and connections among mathematics topics and between mathematics and other subjects. You also will learn how to develop a learning environment that promotes learning mathematics with understanding. Specifically, you will:

- Understand the content, methods, and materials necessary to teach mathematics for Grades K–6.
- Learn about research on children’s mathematical thinking and reform principles about teaching and learning mathematics.
- Learn how to build a learning environment that supports the teaching and learning of mathematics.
- Learn how to assess students’ mathematical thinking and plan instruction based on that assessment.
- Learn to make instructional decisions about the use of curricular materials, such as textbooks, other print resources, manipulatives, and technology in the teaching of elementary school mathematics.

Required Materials

- Van de Walle, J., Bay-Williams, J. M., & Karp, K. M. (2010). *Elementary and middle school mathematics: Teaching developmentally. (7th ed.)*. Boston, MA: Allyn and Bacon/Longman, Inc.
- Van de Walle, J., Karp, K. M., Bay-Williams, J. M. (2010). *Field Experience Guide: Resources for Teachers of Elementary and Middle School Mathematics. (3rd ed.)*. Boston, MA: Allyn and Bacon/Longman, Inc.
- Math 402 Packet (download from the course Web site)
- Additional readings furnished or requested by the instructor

Course Requirements

Attendance, Participation, and Mathematical Disposition. Attendance is an important part of your grade. Your active participation in each class session is vital to your learning as well as the learning of other students in the class. I expect you to attend all class meetings prepared and to be engaged as an active, collaborative participant during each class session, whether whole-class discussion, collaborative-group activity, or individual reflection is involved. Preparation for class includes completion of assigned readings and tasks. If you are unable to attend a particular class session, let me know before class. You are responsible for contacting someone in the class to find out what transpired in your absence. Assignments are to be submitted on time even if you are absent. Assignments are due at the beginning of the class period. Late assignments are scored at a maximum of half credit. Make-up quizzes may be scheduled only in the event of documented illness or emergency. You are expected to adhere to the classroom and testing procedures set forth for this class.

Professional disposition is expected at all times. Learning mathematics extends beyond learning concepts, procedures, and their applications. It also includes developing a disposition toward mathematics and seeing mathematics as a

powerful way for looking at situations (National Council of Teachers of Mathematics [NCTM], *Curriculum and Evaluation Standards for School Mathematics*, 1989, p. 233). Your mathematical disposition will be assessed using the recommendations of Standard 10 in the NCTM *Curriculum and Evaluation Standards*:

The assessment of students' mathematical disposition should seek information about their—

- confidence in using mathematics to solve problems, to communicate ideas, and to reason;
- flexibility in exploring mathematical ideas and trying alternative methods in solving problems;
- willingness to persevere in mathematical tasks;
- interest, curiosity, and inventiveness in doing mathematics;
- inclination to monitor and reflect on their own thinking and performance;
- valuing the application of mathematics to situations arising in other disciplines and everyday experiences;
- appreciation of the role of mathematics in our culture and its value as a tool and as a language.

Mathematics Computation Test. You will take a basic skills test during the second week of the course. The test assesses your knowledge of whole numbers, fractions, decimals, ratio, percent, area, and perimeter. **A minimum score of 80% is required for a grade of C or better in the course.** A practice test is on the course Web site.

Children's Literature Review. You will select a children's book about mathematics from the set of books in the Mathematics Education Lab (DuSable 306). You will write a review of the book based on particular criteria and prepare a five-minute presentation for sharing in small groups of teachers in this class. You will receive detailed information on this assignment in class.

Illuminations Assignment. You will select a lesson from this resource, write a report based on particular criteria, and prepare a ten-minute presentation for sharing in small groups of teachers in this class. You will receive detailed information on this assignment in class.

Questions for Student Interview and Report of Student Interview. You will prepare questions to assess one elementary school student's understanding of whole number operations. You will submit this typed set of questions to me for feedback before you interview the student. You will then interview an elementary student and assess the student's understanding of whole number operations. In a typed report you will describe the student's understandings and suggest appropriate instruction based on this assessment. You will receive detailed information on these assignments in class.

Mathematics Lesson. You will plan a mathematics lesson that you will teach during your clinical experience. Your lesson should conform with the spirit of the *Principles and Standards for School Mathematics* (NCTM, 2000). This implies that the lesson should focus on development of conceptual knowledge, problem solving, and active student learning. You will prepare a detailed typed lesson plan for feedback prior to teaching. The classroom teacher will complete an evaluation form on your teaching. You will also reflect on and evaluate your teaching in a typed report. You will receive detailed information on this assignment in class.

Reflective Writing. You will occasionally prepare short written assignments during or outside of class that are related to the assigned readings and class activities. These assignments are designed to encourage you to reflect on and extend your thinking about particular topics. Reflective writing assigned as part of a class session must be completed during class on the day given.

Curriculum Evaluation. You will examine a lesson from an elementary mathematics textbook and evaluate the lesson using the framework of the *Principles and Standards for School Mathematics* (NCTM, 2000). You will receive detailed information about the typed assignment in class.

Resource Portfolio of Class Assignments and Materials. You will keep a 3-ring binder that contains the Math 402 Packet, completed assignments, all course handouts, reflective writing assignments, and materials distributed by other class members. You will bring this binder to class on the assigned date.

Quizzes. You will complete two quizzes during the semester as scheduled on the syllabus. You will have access to manipulative materials that are available in the Mathematics Education Lab during the quizzes.

Final Exam. The final exam will be comprehensive. You must take the final exam with your fellow classmates at the scheduled time, which is **Wednesday, December 9, 2009, at 8:00-9:50 p.m.** Location to be announced.

Evaluation

Your final grade will be determined as follows:

<u>Assignments and Tests</u>	<u>Percent of Total Grade</u>	<u>Points</u>
Attendance, participation, and mathematical disposition	10%	20
Mathematics computation test*	0	0
Children's literature review	4%	8
Illuminations assignment	5%	10
Questions for student interview and report of interview	15%	30
Mathematics lesson	10%	20
Reflective writing	5%	10
Curriculum evaluation	10%	20
Resource portfolio	1%	2
Quizzes	15%	30
Final exam	25%	50

***A minimum score of 80% is needed for a grade of C or better in the course**

Grading Scale

A 90% - 100 % of point total	B 80% - 89.9% of point total	C 70% - 79.9 % of point total
D 60% - 69.9% of point total	F Below 60%	

Performance Standards for Student Work

Level

Standard to be Achieved for Performance at Specified Level

- A Fully achieves the purpose of assignments. Insightfully interprets assignments, extends beyond assignments, or raises thought provoking questions. Shows clear understanding of concepts. Communicates effectively.
- B Substantially completes purposes of assignments. Displays clear understanding of concepts, even though some less important ideas may be missing. Communicates successfully.
- C Purposes of assignments not fully achieved; elaboration needed. Displays understanding of major concepts, even though some less important ideas may be missing. Limits communication to some important ideas. Results may be incomplete or not clearly presented.
- D Important purposes of assignments not achieved; work may need redirection. Assumptions about the purposes may be flawed. Gaps in conceptual understanding are evident. Approach to assignments may lead away from successful completion. Results may be incomplete. Communication attempted.
- F Purposes of assignments not accomplished. Shows little evidence of appropriate reasoning. Presents fragmented understanding of concepts. Does not successfully communicate relevant ideas. Presents extraneous information.

Semester Schedule

Week 1: August 25, 27

Due August 27: Reflective Writing I—Complete Field Experience Guide, p. 16 (Observation: Evidence of Higher-Level Thinking) using the video-taped lessons shown in class. Responses are to be in paragraph form, not phrases or a list. Type all responses. (Note: Do not type the questions. Your response for each question should be thorough enough for the reader to know the question you answered.)

August 27: Bring to class Field Experience Guide, p. 18 (Teaching: Worthwhile Task Evaluation) and p. 19 (Teaching: Planning a Problem-Based Lesson)

Chapter 1 Teaching Mathematics in the Era of the NCTM Standards

Chapter 2 Exploring What It Means to Know and Do Mathematics

What is involved in teaching elementary school mathematics? What are the recent reforms in mathematics education? What does it mean to know and do mathematics? What does it mean when we say that each person constructs his/her own knowledge? What is conceptual knowledge? What is procedural knowledge? What does it mean to understand mathematics? What are key dimensions of a learning environment that help students understand mathematics?

Week 2: September 1, 3

September 1: Bring to class your completed copy of the Practice Mathematics Computation Test (download the practice test from the course Web site: <http://www.math.niu.edu/courses/402>)

September 3: Mathematics Computation Test

Due September 3: Reflective Writing II—Answer the following questions. Responses are to be in paragraph form, not phrases or a list. Type all responses. (Note: Do not type the questions. Your response for each question should be thorough enough for the reader to know the question you answered.)

1. What is meant by the process standards as referred to in the *Principles and Standards* (NCTM, 2000)? Briefly explain each process standard.
2. How would you describe what it means to “do mathematics”?
3. Why is doing paper-and-pencil computation not “doing mathematics”?
4. What features of a classroom environment are important for students to be engaged in “doing mathematics”?
5. What are the five strands of mathematical proficiency? Briefly explain each strand.
6. Explain how the reform vision of mathematics education aligns or conflicts with your personal view of mathematics education.

Chapter 5 Building Assessment into Instruction

Chapter 8 Developing Early Number Concepts and Number Sense

Additional readings

How do we assess children’s mathematical thinking? How do we gather information from students about what they understand? What do we do with the information we gather? How is assessment related to teaching?

What is number sense? What is a number? What is conservation of number? What is a numeral? What kind of tasks can help students connect numbers to real-world situations? What kinds of tasks can help students use early number relationships to develop early mental computation?

Week 3: September 8, 10

Due September 8: Bring to class your Math 402 Course Packet to class (download from course Web site)

Chapter 9 Developing Meanings for the Operations

Chapter 10 Helping Children Master the Basic Facts

How do children learn addition and subtraction? What are the types of addition and subtraction problems? What solution strategies do children use to solve these types of problems? How does students’ choice of solution strategies facilitate assessment of children’s mathematical thinking? How is this assessment related to teaching? How do children think about multiplication and division? What are the types of multiplication and division problems? What solution strategies do children use to solve these types of problems?

What are basic facts? What is mastery of basic facts? What is an efficient strategy? When is it appropriate to use drill and how can it help? What are some reasons to avoid using timed tests as a means of learning basic facts? What are some ways to help older children who have not learned basic facts?

Week 4: September 15, 17

Due September 15: Children’s Literature Assignment

Due September 17: Questions for Student Interview (Note: Each student must have a unique set of questions for the interview, even though you worked in groups in class.)

Chapter 11 Developing Whole-Number Place Value

Chapter 12 Developing Strategies for Whole-Number Computation

What is place value? What is the importance of place value in whole number operations? What are equivalent representations? How would you describe good place-value number sense?

How can we elicit and discuss the various methods students use to solve problems?

Week 5: September 22, 24

September 24: Quiz on Place Value

Due September 24: Prepared fraction circles (following directions given in class)

Due September 24: Bring 3 copies of Field Experience Guide p. 216 (1-cm Square/Diagonal Grid–40)

Chapter 12 Developing Strategies for Whole-Number Computation

Chapter 15 Developing Fraction Concepts

Chapter 16 Developing Strategies for Computation with Fractions

What is a fraction? How do children learn fractions? What are the possible representations to use with fractions? What are the advantages and limitations of particular representations? How do you gather information about students’ understandings of fractions?

Week 6: September 29, October 1

Due October 1: Bring 3 copies of Field Experience Guide p. 203 (10 × 10 Grids–27)

Chapter 16 Developing Strategies for Computation with Fractions

Chapter 17 Developing Concepts of Decimal and Percents

What should be emphasized in order for children to develop good number sense with decimals? What is the relationship between fractions and decimals? What is the relationship between decimals and percents?

Week 7: October 6, 8

Due October 6: Report of Student Interview

October 8: Quiz on Fraction Operations

Chapter 15 Algebraic Reasoning, pp. 259-275 and lesson on p. 276

What is algebraic reasoning? What are beginning algebra concepts? What is the role of patterns in learning algebra? How does algebra relate to the real world?

Week 8: October 13, 15

Chapter 4 Planning in the Problem Based Classroom

Chapter 6 Teaching Mathematics Equitably to All Children

What is the teacher's purpose or agenda before, during, and after a lesson? How do we reach all children when we teach mathematics?

Week 9: October 20, 22

Due October 20: Final Lesson Plan

Due October 20: Make 1 copy of Field Experience Guide pp. 217-222 (Assorted Shapes—41 through 46). Cut out all the shapes and bring to class.

Due October 22: Curriculum Evaluation Project

Chapter 21 Geometric Thinking and Geometric Concepts

What does it mean to think geometrically? What are the van Hiele levels of geometric learning and how are they useful? How can we assess students' spatial sense and geometric reasoning?

Weeks 10-12: October 26-November 13

Clinical Experience:

- **Teach mathematics lesson previously approved by the instructor**
- **Report from the classroom teacher is due immediately after teaching the lesson. (Send to instructor via U. S. mail in the provided envelope.)**

Week 13: November 17, 19

Due November 19: Report of the lesson and written reflection on your personal evaluation of your teaching

Chapter 19 Developing Measurement Concepts

Chapter 7 Technology and School Mathematics

What concepts of measurement should elementary students understand? How do children learn measurement concepts? What is the role of estimation in learning measurement?

What are the benefits of using calculators in mathematics instruction? How do you address common misconceptions about calculator use? How might computers be used as a tool in mathematics instruction? What are some good criteria for selecting and using software?

Week 14: November 24

Due November 24: Illuminations Assignment

Chapter 18 Proportional Reasoning

What is proportional reasoning? How do students develop proportional reasoning?

Week 15: December 1, 3

Due December 1: Written Reflection III: Complete Field Experience Guide, p. 50 (Evaluating Mathematics Software or Web Sites) for one Web site. Make a copy of p. 50. Complete the top portion and circle the rating for each criterion. On a separate sheet of paper, type the number of each criterion and write your comment for that criterion. Staple the pages with the copy of p. 50 on top.

Due December 1: Resource Portfolio

Chapter 21 Developing Concepts of Data Analysis

Chapter 22 Exploring Concepts of Probability

Final Exam: Wednesday, December 9, 2009, at 8:00-9:50 p.m. Location to be announced.

Note: Changes and adjustments may be made to this syllabus when judged appropriate by the instructor. Such changes, should they occur, will be announced in class.

Students with Disabilities: NIU abides by Section 504 of the Rehabilitation Act of 1973 which mandates reasonable accommodations be provided for qualified students with disabilities. If you have a disability and may require some type of instructional and/or examination accommodation, please contact me early in the semester so that I can provide or facilitate in providing accommodations you may need. If you have not already done so, you will need to register with the Center for Access-Ability Resources (CAAR), the designated office on campus to provide service and administer exams with accommodations for student with disabilities. The CAAR office is located on the 4th floor of the University Health Services building (815-753-1303).

Academic Conduct: Academic honesty and mutual respect (among students and between instructor and students) are expected in this course. Academic misconduct, as defined by the Student Judicial Code, will not be tolerated. Professional disposition is expected at all times.

General Classroom Etiquette:

- Turn off pagers, phones, hands-free phones, PDAs, iPods, headsets, etc. before entering the classroom.
- No pagers, phones, hands-free phones, PDAs, iPods, headsets etc. can be used for any in-class work including quizzes, exams, and reflections.
- Plan to arrive on time, come prepared to class, stay to the end of class, and be in the classroom for the entire session, unless you have an emergency situation.
- Only students who are registered for this course should attend class sessions.
- Give your attention to the presenters during class, whoever they may be.
- Professional disposition is expected at all times.

Course Lab Fee: A lab fee charged for enrollment in this course is used to replace and update materials pertaining to instruction of the course and research on instruction of the course.