

***Methods of Instruction in the Mathematics Curriculum
for the Elementary School (K-6)***

MATH 402 Fall 2009
DuSable Hall 306 (Mathematics Education Laboratory)

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COURSE PAGE: <http://www.math.niu.edu/courses/math402>

COURSE OBJECTIVES:

This semester, you are to undertake an investigation into the learning and teaching of mathematics at the elementary level. Your inquiry will support your initial mathematics teaching endeavors and enable you to continue learning as your teaching practice matures. You will investigate how children 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 within and between mathematics ideas. You also will learn how to encourage expectations for self-reliance in students and how to build a foundation of knowledge to support their more advanced study of mathematics. Specifically, you will:

- understand the content (what), methods (how), and materials (manipulatives and tools) necessary to teach elementary mathematics;
- understand different types and characteristics of knowledge and learning in mathematics;
- understand how to informally assess students' mathematical thinking and plan appropriate instruction;
- learn how to build an instructional environment that supports the teaching and learning of mathematics;
- learn how to make instructional decisions about the use of curricular materials, manipulative materials, technology, supplemental materials.

COURSE TEXTS:

Van de Walle, J. (2009). *Elementary and middle school mathematics: Teaching developmentally*. (7th ed.). New York, NY: Addison Allyn and Bacon.

Van de Walle, J. (2007). *Field Experience Guide: Resources for Teachers of Elementary and Middle School Mathematics*. Boston, MA: Allyn and Bacon/Longman, Inc.

Additional Readings on the course web pages, or furnished by instructor

NIU/ETA Manipulative Starter Kit by ETA/Cuisenaire Company (optional -- \$44.04)

EVALUATION: Course grades will be determined according to point totals accumulated during the semester. A student must complete all assignments in order to receive a grade of “C” or higher for the course. Activities and point values are as follow:

Mathematical Disposition		
Attendance/Participation/Disposition	6 7/8%	11 pts
Reflective Writing & Assignments		
Self-Identity Philosophy Development	2 1/2%	4 pts
Problem Solving Using Children’s Literature	6 7/8%	11 pts
Working Portfolio w/Assignments	6 7/8%	11 pts
Weekly Reflections & Reading Quizzes	3 3/4%	6 pts
Illuminations: Electronic Resource Report	3 3/4%	6 pts
Student Interview Protocol	2 1/2%	4 pts
Student Interview Assessment	3 3/4%	6 pts
Basal Textbook Lesson Analysis	3 3/4%	6 pts
Lesson Plan for Clinical Experience	3 3/4%	6 pts
Lesson Plan Self Analysis/ Teacher Report	2 1/2%	4 pts
Mathematics Computation Assessment	0%	*
Three (3) In-Class Quizzes (@ 15 points each)	28 1/8%	45 pts
Final Exam	25%	40 pts

MATH 402 Final Exam is Wednesday, December 9th, 8-9:50 p.m. Location: TBA

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%

* The mathematics computation quiz must be successfully completed with a score of 80% or more, in order to receive a grade of “C” or higher for the course. Not turning in an assignment can result in course failure, regardless of the points involved.

ASSESSMENT STANDARDS:

Level	Standard to be achieved for performance at a specified level
A	Student fully achieves the goals and objectives of the assignment, has made accurate observations, drawn insightful conclusions and/or extensions, and shows clear understanding of concepts. Communicates effectively.
B	Student substantially achieves goals and objectives of the assignment, displays clear understanding of concepts, although some less important ideas may not be in place. Communicate successfully
C	Student addresses all aspects of assignment, but goals and objectives may not be fully met. Student displays understanding of concepts, although elaboration may be needed and some less important ideas may not be in place. Student gives limited communication of some important ideas. Results may be incomplete or not clearly presented
D	Important goals or objectives of the assignment are not met. Work may need redirection. Gaps in conceptual understanding are present. Student’s approach to assignment may lead away from assignment completion. Assumptions and/or conclusions are incomplete, or flawed. Attempts communication.
F	Goals and objectives of the assignment are not met. Shows little or not evidence of appropriate reasoning. Presents fragmented understanding of concepts. Presents erroneous or extraneous conclusions.

COURSE REQUIREMENTS:

ATTENDANCE, CLASS PARTICIPATION, MATHEMATICAL DISPOSITION – **Your active participation in each class session is vital to your learning as well as to the learning of other students in the class. I expect you to attend all class meetings prepared for active, collaborative, participation during the session, whether it is whole group discussion, small group activity, or individual reflection.** Preparation for class involves completion of assigned readings and tasks. If you are unable to attend a particular class session, please let me know beforehand. You are responsible for contacting someone in the class to find out what transpired in your absence. **You will need to write up a description of what occurred in your absence.**

Late work will not be accepted. Make-up quizzes or tests may be scheduled only in the event of documented illness or emergency.

MATHEMATICAL DISPOSITION: 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 Curriculum and Evaluation Standards for School Mathematics, p. 233). The following list is how I will be assessing your mathematical disposition. This list is from Standard 10 of the evaluation standards in the previous named source.

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 of the application of math. 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.

WORKING PORTFOLIO – Individually prepare a professional notebook containing a statement of your Personal Philosophy of Mathematics Education, Reflective Writings, Lesson Plan and Implementation Report, Journal Article Report, Lesson Analysis, Interview Protocol and Assessment Report, Various Assignments, and Other Items as announced. *Hint: Get a 3-ring binder, insertable index dividers, and a hole-punch. Put your Math 402 Resource Packet in the back. Then, as projects and presentations are completed, you can add to your notebook regularly.* Near the end of the term re-organize your notebook in a logical fashion suitable for your use and prepare a durable table of contents enabling a user of your materials to find items as you have classified them. ***A Table-of-Contents with pagination is expected.***

PROBLEM SOLVING PRESENTATION USING CHILDREN'S LITERATURE: You are to select a piece of children's literature that can be developed into a problem-solving lesson or that can be used to provide the context (theme) for a series of mathematics lessons. The piece of literature (a children's storybook) you may select may be either: (a) a story that deals directly with a mathematical concept or (b) a story that can be used as a theme for generating problems. *The problems should not be simply counting the number of objects in a picture, but involve higher-order concepts.* You will present your book and problem situations in a small group. We will read in class: *The Doorbell Rang*; *How Big Is A Foot*; *The Math Curse*; and *Click, Clack, Moo: Cows That Type*. So you should NOT use any of these four books.

PERSONAL SELF-IDENTITY & PHILOSOPHY DEVELOPMENT: Your philosophy should begin with the following six paragraphs: (1) the purpose of education and schools, (2) the role and responsibility of the student, (3) the role and responsibility of the teacher, (4) what is mathematics, (5) effective learning strategies, and (6) effective teaching strategies. [Aggregate: about one single-spaced page typed in a well thought out, coherent manner.] Your second draft is due the fourth class meeting. *You are required to have two people in class proofread your philosophy and sign your second draft.* (You also are required to proofread and OK two other people's drafts.) Type the final draft. Have the final draft and your earlier drafts (dated) in front of your portfolio.

ILLUMINATIONS: ELECTRONIC RESOURCE REPORT: You will prepare an evaluative discussion of an of a mathematics lesson at the following electronic resource of the National Council of Teachers of Mathematics:

Electronic Resource at NCTM Illuminations: <http://illuminations.nctm.org/>

Prepare a typed, double-spaced, 2-3 page review of your including the following items:

- Give a 1-paragraph summary of the main idea of the lesson as described on the course webpage.
- Turn in a copy of the downloaded lesson, with teacher worksheets and/or student worksheets.
- Identify specific components of the mathematics content of the lesson.
- Provide an analysis that includes the essential mathematical ideas students will learn from the activity.
- Give specific examples of the ways you intend to use the activity in your teaching in order to improve mathematics instruction in your classroom.
- Specify the grade level where activity might be used and how it could be used.
- Do you think the activity is a good one? If so, why? Be specific.

INTERVIEW PROTOCOL & PREPARATION FOR STUDENT ASSESSMENT. You will prepare a protocol and individual questions to assess an elementary student on a specific mathematics topic. You will turn this *typed protocol* into me for feedback *before* you interview the student. Your questions should be an in-depth examination of a child's levels of understanding of this topic. Your protocol should include:

Part A: The specific objective(s) of your individual mathematics topic;

A **detailed, comprehensive** listing of the **mathematical concepts** of this topic;

A listing of the manipulatives to be used;

Part B: The specific questions, in a logical order of presentation, you will ask on each of your **concepts**

Each of your concepts should be investigated in various contexts: a) with procedures or algorithms; b) with manipulatives; c) with real-world applications

This interview should last approximately 20-25 minutes. You can audiotape the interview so you can concentrate on listening to the child and not on recording notes.

Report & Analysis of Student Interview. You will interview an elementary student. You will assess the student on the concepts that you have prepared. In your typed report you will describe your student's understandings and **provide evidence** from your interview. You should suggest *appropriate instruction* based upon your assessment at the end of your report. Samples of interview protocols, reports of student interviews, and videotapes of interviews are in the mathematics education laboratory.

BASAL TEXTBOOK LESSON ANALYSIS –You will examine and evaluate a mathematics lesson from an elementary textbook at your clinical site. Provide a photocopy of the lesson and resources (student workbook page for example) that goes with the lesson. Identify, copy and read the lesson. (a) Prepare a one-paragraph summary of the lesson in which you identify the main topic of the lesson and describe the main activities in which students will be involved as they complete the lesson. (b) Describe which of the **Content Standards** is addressed in the lesson and explain how the lesson meets the standard. If the lesson fails to meet the standard explain how it could be adapted to do so. If no adaptations are needed, state this and explain why. (c) Describe how the lesson addresses each of the **five Process Standards**. If the lesson does not meet one or

more of the process standards, state this and explain how the lesson *could be adapted* to do so. (d) Using the lesson plan evaluation criteria we develop in class (that will be posted on the course webpage) evaluate the lesson. Illustrate how this lesson does, or does not, meet our criteria. Explain what would be needed to make the lesson appropriate. (e) Explain how the lesson could be adapted for different types of special needs students while still meeting the suitable NCTM Standards. Explain why the adaptations are necessary. If you believe no adaptations are necessary, explain why. Note: It is your decision about what type of special needs student is to be considered (e.g. gifted, LD, physically handicapped, limited English, visual or hearing impaired, etc.). (f) Do a closure to the basal lesson analysis by giving your overall evaluation of the lesson.

LESSON PLAN AND SELF-ANALYSIS – You will prepare and teach a problem-solving LESSON PLAN to students at your clinical setting. You will be assigned a topic area for your lesson. This topic will be selected by meeting with your cooperating teacher and then with me. Your goal is for the lesson to develop concepts from the topic, **specifically the content standards and the five process standards**. This lesson plan needs to fit the lesson plan evaluation criteria we develop in class (that will be posted on the course webpage). You must turn in the lesson plan to me to concur ***before*** you teach the lesson.

After my OK of your lesson plan, you teach this lesson then write up a SELF ANALYSIS (reflection) of your lesson that includes the following: (1) The teacher observation form (on the course webpage). (2) A description of the effectiveness of the lesson in developing understanding of the mathematical content as an: (a) elementary student; (b) experienced teacher; (c) a fellow student in MATH 402; (d) mathematics education researcher (me). (3) A discussion of the things you might do differently the next time you teach the lesson to promote understanding of the mathematics content. (4) A discussion of what you learned by preparing this lesson.

MATHEMATICS COMPUTATION ASSESSMENT – Proficiency in the basic skills should be demonstrated during the semester. To demonstrate proficiency, you will be required to complete a test of basic skills covering fundamental topics in the following areas: whole number, integers, fractions, decimals, geometry, measurement, ratio, proportion, percent, probability and statistics. The mathematics computation quiz must be successfully completed with a score of 80% or more, in order to receive a grade of “C” or higher for the course. A sample quiz is on the course webpage at: <http://www.math.niu.edu/courses/402>.

THREE IN-CLASS QUIZZES – Three quizzes will be completed during class time as scheduled in the syllabus. Material from **both** the textbook and from class discussion will be on the quizzes.

WEEKLY REFLECTIONS & READING QUIZZES – After every class you should take a few minutes to write your reflections of what you learned. Every week you also will be asked to answer a quiz question on the textbook readings for that week.

FINAL EXAM – The final exam will be comprehensive. The two parts of the departmental final exam are common to all MATH 402 sections. *You must take the final exam with your fellow classmates at the scheduled time. The final exam is:*

MATH 402 Final Exam is Wednesday December 9th, 8-9:50 p.m. Location: TBA

SEMESTER SCHEDULE:

Week 1: Introduction and Course Overview (Aug. 24 – Aug. 28)

How Children Learn Mathematics With Understanding

Conceptual and Procedural Knowledge

NCTM's *Principles and Standards*

Read: Ch 1: Teaching Mathematics in the Era of the NCTM Standards

Ch 2: Exploring What It Means To Do Mathematics & Developing Understanding in Math.

Week 2: Problem Solving, Logical Reasoning (Aug. 31 – Sept. 4)

Problem Solving, Estimation, Mental Math, Number Sense

Planning For Instruction

Read: Ch 3: Teaching Through Problem Solving

Ch 4: Planning in the Problem-Based Classroom

Ch 5: Building Assessment into Instruction

Ch 6: Teaching Mathematics Equitably to All Children

Turn In: **Problem-Solving Lesson using Children Literature**

Turn In: **Second draft of your Self-Identity Philosophy of Mathematics Education
Computation Assessment**

LABOR DAY HOLIDAY Sept. 7th

Week 3: Early Number Concepts, Beginning Whole Number Operations (Sept. 8 - 11)

Read: Ch 8: Developing Early Number Concepts and Number Sense

Ch 9: Developing Meanings for the Operations

Ch 10: Helping Children Master the Basic Facts

Quiz 1

NIU Manipulative Kit Orders

Week 4: Place Value Concepts (Sept. 14 – 18)

Read: Ch 11: Whole-Number Place-Value Development

Week 5: Computational Algorithms (Sept. 21 - 25)

Building on Place Value Concepts

Read: Ch 12: Strategies for Whole-Number Computation

Ch 13: Computational Estimation with Whole Numbers

Week 6: Fraction Concepts (Sept. 28 – Oct. 2)

Read: Ch 15: Developing Fraction Concepts

Ch 16: Computation with Fractions

Quiz 2

Week 7: Fractions, Decimals and Percents (Oct. 5 - 9)

Read: Ch 17: Decimal and Percent Concepts and Decimal Computation

Turn In: **Student Interview Protocol**

Week 8: Measurement (Oct. 12 - 16)

Read: Ch 18: Proportional Reasoning
Ch 19: Developing Measurement Concepts
Turn In: **Lesson Plan for Clinical Experience**

Week 9: Algebra Concepts (Oct. 19 - 23)

Read: Ch 14 Algebraic Thinking: Generalizations, Patterns, and Functions
Ch 23 Developing Concepts of Exponents, Integers, and Real Numbers
Turn In: **Student Interview Assessment**
Quiz 3

Week 10: Clinical Experience (Oct. 26 – Oct. 30)

Week 11: Clinical Experience (Nov. 2 - 6)

Week 12: Clinical Experience (Nov. 9- 13)

Week 13: Geometric Thinking (Nov. 16 - 20)

Read: Ch 20: Geometric Thinking and Geometric Concepts
Turn In: **Basal Textbook Analysis**

Week 14: Probability and Statistics (Nov. 23 – 24)

Read: Ch 21: Concepts of Data Analysis
Ch 22: Exploring Concepts of Probability
Turn In: **Illuminations Electronic Resource Report**

THANKSGIVING HOLIDAYS November 25-27th

Week 15: Course closure (Nov. 30 – Dec. 4)

Read: Ch 7: Technology and School Mathematics
Turn In: **Lesson Plan Self-Analysis & Teacher Report Form**
Turn In: **Working Portfolio**

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Note 1: 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.

Note 2: Students with Disabilities:

NIU abides by Section 504 of the Rehabilitation Act of 1973 that 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 accommodation 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 services and administer exams with accommodations for students with disabilities. The CAAR office is located on the 4th floor of the University Health Services building (815-753-1303). I look forward to talking with you soon to learn how I may be helpful in enhancing your academic success in this course.

Note 3: Academic Conduct:

Academic honesty and mutual respect (student with student and instructor with student) are expected in this course. Mutual respect means being on time for class and not leaving early, being prepared to give full attention to class work, not reading newspapers or other material in class, not using cell phones or PDAs during class time, and not looking at another student's work during exams. Academic misconduct, as defined by the Student Judicial Code, will not be treated lightly.

Note 4: MATH 402 is intended for students in education. Accepted for credit as an elementary mathematics methods course, but not as an upper-division mathematical content course. Not open for credit toward the major or minor in mathematical sciences. Not used in major or minor GPA calculation for mathematical sciences majors or minors. PRQ: MATH 201 with a grade of C or better and junior standing or consent of department. *The State of Illinois does not allow MATH 402 as a Middle School Mathematics Methods Course for Middle School Mathematics Endorsement.*

Note 5: Textbooks, basal lesson plans, references, and manipulatives are in the Mathematics Education Laboratory, DU 306, for your convenience. Open lab hours are available for you to use the lab's equipment, e.g., the Ellison Die Cutting and AccuCut Machines, during the semester. There is a lab attendant that can assist you in finding materials and using the materials. Lab hours for this semester will be announced in class and posted outside the laboratory door.

Note 6: *NIU MANIPULATIVE KIT:* This manipulative kit is especially for NIU pre-service teachers, designed by the mathematics education faculty. Most of the manipulatives are overhead projector materials that even well-equipped elementary schools do not have. The manipulatives in the kit would cost, retail, over \$98.90 but our cost is \$44.04 (\$41.00 + \$3.04 shipping/handling). A handbook on using the manipulatives is with the kit. (NIU students bought approximately 240+ kits in the school year.) A list of the manipulatives is at the end of this syllabus. Sign up for a kit by making out a check for \$44.04 to NIU Mathematics Education and putting your section number (P2) and instructor name (Zollman) in the comment space of the check. The deadline for ordering a kit this semester will be announced at the first class session.

Note 7: As in teaching in the public schools, in the Second Professional Semester, adjustments always occur. Changes may be made in this syllabus when judged appropriate by the instructor. Such changes, should they occur, will be announced in class.

Note 8: Of course, your cell phone should be turned **set to vibrate** during class.

MATH 402 Assignments
Fall Semester 2009

Math Disposition & Participation	Throughout Semester
Self-Identity Philosophy Development Paper	Weeks 1 & 15
Computational Quiz (P/F)	Week 2
Problem Solving W/ Children's Literature	Week 2
Quiz 1	Week 3
Optional NIU Manipulative Kit Orders	Week 3
Quiz 2	Week 6
Student Interview Protocol	Week 7
Lesson Plan For Clinical	Week 8
Quiz 3	Week 9
Student Interview Assessment	Week 9
Clinical Experiences	Weeks 10, 11 & 12*
Basal Textbook Analysis	Week 13
Illuminations Electronic Resource Report*	Week 14
Teacher Report Form Of Clinical Teaching*	Week 14
Lesson Plan Teach & Self-Analysis*	Week 15
Working Portfolio*	Week 15
Final Exam	Week 16

***Assignments During Clinical Experience:**

Teach a Math Class (alone) & Self-Analyze (with a Teacher Report Form)

*** Possible Assignments During Clinical Experience or During the Visitation Days:**

Interview a Student & Evaluate

Analyze a Basal Textbook Lesson

Illuminations Electronic Resource Report

As in teaching in the public schools, in the Second Professional Semester, adjustments always occur. Changes may be made in this syllabus when judged appropriate by the instructor.