Purpose of the Course

In this course, we will explore the teaching of mathematics, investigating both *what* to teach and *how* to teach it. The purpose of this course is to begin an inquiry into mathematics teaching and learning that will guide you in your first teaching job and give you tools that will enable you to continue to inquire and learn as part of your work as a teacher. Traditionally, a mathematics methods course is designed to teach preservice teachers how to teach the mathematics they already know. Instructors and students in such a course have assumed that what is to be taught is the content covered in the mathematics lessons preservice teachers experienced as elementary school students. But current national reforms in mathematics education are calling for elementary teachers to think in new ways about pedagogy—*or how* to teach—as well as about the content of their instruction—*or what* to teach.

The purpose of this course is to help you learn to think of the mathematics you teach from the vantage point of the child who is learning. You will have the opportunity to explore the teaching of mathematics through investigating how children learn mathematics in the areas of whole numbers, fractions, decimals, and geometry. You will begin to learn what it means to understand mathematics deeply in these areas and begin to learn to see relationships and connections within and between mathematical ideas. The aim is to begin to help you develop ways of thinking about mathematics, about students, and about the teaching and learning of mathematics in each of these areas.

At the end of your participation in this course, you should have new questions and insights about the processes of teaching and learning mathematics, as well as about the subject itself. You should have some new understandings of mathematics and some new mathematical interests. You should have ways of thinking about mathematics teaching that will help you make instructional decisions about curriculum, tasks, materials, tools, and representations.

Organization of the Course

We will explore what it means to do mathematics and what it means to understand mathematics through individual, small group, and large group mathematical problem solving. We will investigate ways to represent understandings of mathematical concepts, communicate reasoning about mathematical ideas, and construct mathematical arguments. We will investigate and read about ways students might represent mathematical concepts. We will look at ways to help students build connections and see relationships among mathematical ideas.

We will also explore what it means to teach mathematics through a study of six dimensions of mathematics teaching and learning that encompass the vision of the current reforms in mathematics education. These dimensions are (1) creating a classroom environment that is conducive for mathematical learning, (2) using appropriate mathematical tasks, (3) using appropriate mathematical tools, (4) understanding the role of teachers in class discussion, (5) understanding the role of students in class discussion, and (6) assessing mathematical understanding.

Course Goals and Objectives

1. Understand the content (what), methods (how), and materials (tools) necessary to teach mathematics.
2. Understand connections between mathematical procedures and concepts within a problem-solving environment.
3. Understand how to assess children’s mathematical thinking and plan instruction based on this assessment.
4. Examine beliefs and knowledge about the goals and content of elementary school mathematics.
5. Understand what it means to build a learning environment that supports the teaching and learning of mathematics.
6. Understand the importance of mathematical discourse for students to learn to communicate their reasoning and make sense of mathematical ideas.
7. Learn how to ask children questions and interpret their answers to gain insight into their mathematical thinking.
8. Learn to make instructional decisions about the use of curricular materials, such as textbooks and other print resources, manipulative materials, and technology in the teaching of elementary school mathematics.

Course Requirements

Required materials:


Math 402 Packet can be copied from the following website.
http://www.math.niu.edu/courses/402/

Additional Readings on reserve and furnished by instructor

Optional materials:
Manipulative Starter Kit by ETA

Attendance, participation, and mathematical disposition: Attendance is an important part of your grade. This course is not a read-and-lecture class. Your active participation in each class session is vital to your learning as well as to the learning of the other students in this course. You are expected to be on time for class. Tardiness is considered as a lack of attendance. You are expected to exhibit a positive, open-hearted attitude during class discussions and activities. You are expected to attend all class meetings prepared and to be engaged as an active, collaborative participant during each class session. Being prepared means doing the readings for each session and considering the questions provided for each reading before coming to class. If you are unable to attend a particular class session, please let me instructor know beforehand. You are responsible for contacting someone in the class or me to find out what transpired in your absence.

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 listing is how you will be assessed on 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 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.

Mathematical disposition will play a large role in part of your grade.

Course Assignments: You will have assignments across the semester. They are as follows:

Reflective Writing. During the semester you will do written reflections on your learning. The aim is to provide a formal way for you to critically reflect about the ideas that emerge through the course readings and activities. These
reflections could be in- or out-of-class assignments. All out-of-class reflections should be typed. Your first reflection will be a mathematics autobiography. In your autobiography you will tell about your past study of mathematics and your success in it. You will more receive information in class. Reflective writing, the packet, and all other course handouts will be required to be kept in a 3-ring binder which you will bring to class the last week.

*Electronic Resource Report.* You will prepare a typed article report in which you summarize a lesson that you found on the *Illuminations* website. You will discuss the strengths, weaknesses, and how you will use this lesson in your teaching. You will more receive information in class.

*Questions for Student Assessment Interview.* You will prepare questions to assess an elementary student on a particular mathematics concept. You will turn in this typed report for feedback before you interview the student. You will receive more information in class.

*Report of Student Interview.* You will interview an elementary student. You will assess the student on the concept that you have prepared. In this report you will describe the student's understandings and suggest appropriate instruction based upon your analysis of the student’s understanding. You will type this assessment report. You will receive more information in class.

*Problem-Solving Lesson Taught to Students in Your Clinical.* The purpose of this assignment is to develop a mathematics lesson in the spirit of the expectations and ideas presented in the NCTM *Principles and Standards for School Mathematics* (2000) for a particular content strand and grade band and to evaluate the effectiveness of the lesson. The content strand will either be measurement or geometry. You will more receive information in class.

You will be required to complete two testing situations. They are as follows:

*Mathematics Computation Quiz.* At the beginning of the semester you will be given a quiz that involves basic mathematics computations such as addition, subtraction, multiplication, division, fractions, decimals, percents, ratios, proportions, and measurement. This quiz must be successfully completed by receiving a score of 80% or better before a grade of “C” or better will be assigned for the course.

*Final Exam.* The final exam will be comprehensive. You must take the departmental final examination with your fellow classmates at the scheduled time.

**Evaluation**

<table>
<thead>
<tr>
<th>Level</th>
<th>Standard to be achieved for performance at specified level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fully achieves the purpose of the assignments while insightfully interpreting, extending beyond the assignments, or raising thought provoking questions. Shows clear understanding of the concepts. Communicates effectively.</td>
</tr>
<tr>
<td>B</td>
<td>Substantially completes purposes of the assignments. Displays clear understanding of concepts, even though some less important ideas may be missing. Communicates successfully.</td>
</tr>
<tr>
<td>C</td>
<td>Purposes of the assignments not fully achieved; needs elaboration. 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.</td>
</tr>
<tr>
<td>D</td>
<td>Important purposes of the 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 their completion. Results may be incomplete. Attempts communication.</td>
</tr>
</tbody>
</table>
The grading scale will be approximately as follows:

<table>
<thead>
<tr>
<th>Points Range</th>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-200 points</td>
<td>90% or above</td>
<td>A</td>
</tr>
<tr>
<td>160-179 points</td>
<td>80-89%</td>
<td>B</td>
</tr>
<tr>
<td>140-159 points</td>
<td>70-79%</td>
<td>C</td>
</tr>
<tr>
<td>120-139 points</td>
<td>60-69%</td>
<td>D</td>
</tr>
<tr>
<td>Below 60%</td>
<td></td>
<td>F</td>
</tr>
</tbody>
</table>

Your final grade will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent of total grade</th>
<th>Number of points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance, participation, and mathematical disposition</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Reflective writing</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Electronic Resource Report</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Preparation for Student Interview</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Report of Student Interview</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Problem-Solving Lesson and Evaluation</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Math Computation Quiz</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100.0</strong></td>
<td><strong>200</strong></td>
</tr>
</tbody>
</table>

**Note:** All assignments will be expected to be completed on time even if you are absent. Assignments are due at the beginning of the class period. They may be turned in after the class period for a maximum of half credit. If you expect to turn in a late assignment, you must talk to me beforehand.

No assignments will be accepted after December 4, 2007.

**Notes:**

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 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).

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 pagers 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.

Reminders: General Classroom Etiquette
* Turn off pagers, phones, etc.
* No palm pilots, PDA's, etc. can be used for any in-class work including quizzes, exams
* Plan to arrive on time, stay to the end of class, and be in the classroom for the entire session
* Only students who are registered for this course should attend this class
* Come prepared for class (see p. 2 of this document)
* Give your attention to the presenters in this class, whoever they may be.
Semester Schedule

Week 1
August 28, 30
What is involved in teaching elementary school mathematics? What are your experiences with mathematics? What are your beliefs about how mathematics should be learned and taught? What are the recent reforms in mathematics education? What are the key dimensions of a learning environment that helps students to understand mathematics? How can the learning environment help all students become mathematical thinkers? What can teachers do to convey the value of students’ ideas? What classroom structures encourage and support collaboration between students? How do students learn to respect each others’ ideas? How do students learn mathematics through discourse? What is the teacher’s role in the discourse in the classroom? How does a teacher pose questions that elicit students’ responses? How does a teacher pose questions that challenge students to learn? How does a teacher engage all students in the discourse? How does a teacher make decisions about when and how long to ask students to struggle for answers? How does a teacher decide which students’ ideas to pursue?

What is conceptual knowledge? What is procedural knowledge? What does it mean to understand mathematics? What does it mean to say “we construct our own” knowledge as opposed to “we absorb” knowledge? What are the benefits of relational understanding?

How do teachers assess children’s mathematical thinking? How do teachers gather information from students about what students understand? What does a teacher do with knowledge of what students understand? How does assessment relate to teaching?

Read Chapter 1 Teaching Mathematics in the Era if the NCTM Standards
Read Chapter 3 Developing Understanding in Mathematics
Read Chapter 6 Building Assessment Into Instruction

Week 2
September 4, 6
What is number sense? What is a number? Conservation of number? What is a numeral? How do children learn addition and subtraction? What are the types of addition and subtraction problems? What solution strategies do they use to solve these different types of problems? How do children think about multiplication and division? What are the different types of multiplication and division problems?

Read Chapter 9 Development Early Number Concepts and Number Sense
Read Chapter 10 Developing Meanings for the Operations
Automobiography Due (Reflective Writing 1)—September 4
Math Computation Quiz—September 6

Week 3
September 11, 13
What are the relationships among addition, subtraction, multiplication, and division? What is its importance in all these operations? What strategies and algorithms do students invent to solve addition, subtraction, multiplication, and division problems? What are direct modeling strategies? What is the area model for multiplication? What is place value? How can you help children understand place value?

Read Chapter 12 Whole Number Place-Value Development
Electronic Resource Report Due—September 13

Week 4
September 18, 20
What is a fraction? How do children learn fractions? What are fractional parts? What are fractional models? What are fractions in the elementary curriculum? What are possible representations to use with fractions? What conceptual understandings of fractions are illustrated with particular representations? What are the advantages and limitations of particular representations?
Read Chapter 16  Developing Fraction Concepts

Reflective Writing 2 Due

Week 5
September 25,27
What is the importance of word problems in teaching fractions? Explain how real-life situations help in understanding fractions? What is involved in planning a problem-based lesson? What is the role of the teacher? the students? the task? manipulatives? How do you assess students learning in a problem-based task setting? What is the value of teaching through problem solving? What are examples of problem-based tasks? What are the teachers’ purpose or agenda before, during, and after a lesson?

Read Chapter 17  Computation With Fractions

Questions for Student Interview Due—September 25

Reflective Writing 3 Due

Week 6
October 2, 4
How do we teach mathematics to all children? How do students connect multiple representations to fraction algorithms? How does estimation help students to evaluate answers from fraction algorithms? How do students develop fraction algorithms conceptually?

Reflective Writing 4 Due

Week 7
October 9, 11
What does it mean to think geometrically? What are the van Hiele levels for geometric learning? Why are the van Hiele levels important for learning and teaching geometry? Why is important to study geometry? Why are multiple representations important in learning geometry?

Read Chapter 21  Geometric Thinking and Geometric Concepts

Report of Student Interview Due—October 11

Week 8
October 16, 18
What concepts of measurement should elementary students understand? How do children learn measurement concepts?

Read Chapter 20  Developing Measurement Concepts

Problem-Solving Lesson Plan Due—October 16

Reflective Writing 5 Due

Week 9
October 23, 25
Complete revision of problem-solving lesson. Pull together ideas and practices of teaching mathematics for the clinical experience.

Week 10-12
October 29-November 16
Clinical Experience

Week 13
November 20
Discuss experience teaching mathematics during the clinicals.
Begin lesson analysis using NCTM Standards
**Week 14**  
November 27, 29  
*What are beginning algebraic concepts? What is the role of patterns in learning algebra? How does algebra relate to the real world? How can students learn to use algebra in their everyday mathematics? What is a mathematical pattern? What are ways we can help students generalize patterns? What are ways we can help students understand variables?*

Read Chapter 15  Algebraic Thinking: Generalizations, Patterns, and Functions  
Continue lesson analysis using NCTM Standards  
**Problem-Solving Lesson Plan with Analysis Due—November 27**

**Week 15**  
December 4, 6  
*What is the relationship between fractions and decimals? What is the relationship between decimals and percents? What are models that can be used for students to learn decimals and percents conceptually? What are ways of representing decimal concepts and computations? What should be emphasized in if you want children to have good number sense with decimals?*

Conceptual understanding of the mean.

Read Chapter 18  Decimal and Percent Concepts and Decimal Computation  
**Reflective Writing 6 Due—December 6**

**Week 16**

**Final Exam Will Be Wednesday. December 12 from 8:00-9:50 PM.**

*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.*