

**George Mason University**  
**EDCI 552-002: MATH METHODS FOR THE ELEMENTARY CLASSROOM**  
 Fall 2011

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**I. Course Description**

This course introduces methods for teaching all children topics in arithmetic, geometry, algebra, probability, and statistics in elementary grades. It focuses on using manipulatives and technologies to explore mathematics and solve problems.

*Prerequisite:* Admission to the Elementary Education Licensure Program

**II. Student Outcomes**

This course will enable students to:

- A. Know what constitute the essential topics in mathematics of the modern early and intermediate grades school program.
- B. Identify and use selected manipulatives and technology such as linking cubes, attribute blocks, geoboards, base-10 blocks, fraction circles, tangrams, calculators, and computers to teach appropriate mathematics content topics in the early and middle grades.
- C. Identify and use various instructional strategies and techniques (cooperative and peer group learning, activity centers, laboratories and workshops, teacher-directed presentations, etc.) to teach mathematical content topics appropriate for the early and intermediate grades to all children, including those from non-mainstreamed populations.
- D. Identify and use alternative methods for assessing students' work in mathematics in the early and intermediate grades.
- E. Solve problems in the mathematical content areas of logic, number theory, geometry, algebra, probability, and statistics appropriate for adaptation to the early and intermediate grades.
- F. Know and explain a standards-based mathematics curriculum, the key elements of the National Council of Teachers of Mathematics Principles and Standards for School Mathematics, and the key elements of the Virginia Standards of Learning for Mathematics.

Additionally, this course supports the CEHD Core Values of collaboration, ethical leadership, research-based practice, social justice, and innovation. Statements of these goals are at <http://cehd.gmu.edu/values/>.

**III. Relationship to Program Goals and Professional Organizations Student Outcomes Referenced to Selected National Standards**

Course Student Outcomes (above)	NCTM Principles and Standards	ISTE NETS	ACEI
A	S1, S2, S3, S4, S5	SI	1.0
B	S10	SII	3.1
C	P1, P2, P3, P4, P6	SII	1.0, 2.3, 3.1, 3.3, 3.4
D	P5	SIV	4.0
E	S1, S2, S3, S5, S6	SI	2.3
F	S1-10, P1-6	SI	1.0

Key:

NCTM Principles and Standards = National Council of Teachers of Mathematics Principles and Standards for School Mathematics (2000), where P = principles and S = standards.

NETS = International Society for Technology in Education National Education Technology Standards 2000, where S = standard number

ACEI = Association for Childhood Education International Elementary Education Standards

#### **IV. Nature of Course Delivery**

In this course we will begin an inquiry into mathematics teaching and learning that will guide you in your first teaching job and give you the tools that will enable you to continue to inquire and learn as part of your work as a teacher. Class sessions will be interactive and will include a variety of hands-on experiences with concrete and virtual manipulatives appropriate for elementary school mathematics. We will explore the teaching of mathematics, investigating both *what* to teach and *how* to teach it. 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 children might represent mathematical concepts, looking at ways to help children build connections and see relationships among mathematical ideas. We will explore characteristics of a classroom environment conducive to mathematical learning by reading and discussing the importance of mathematical tasks, mathematical tools, the roles of teachers and students, and the assessment of mathematical understanding.

#### **V. Required Texts & Readings**

Van De Walle, J., Karp, K. S., & Bay-Williams, J. M. (2010). *Elementary and Middle School Mathematics: Teaching Developmentally*. (7th edition) New York: Allyn & Bacon.

A student membership in NCTM is recommended but not required. \$39 per year from <http://www.nctm.org/membership/content.aspx?id=7618>

#### **VI. Course Requirements and Assignments**

**Attendance.** It is your responsibility to attend all class sessions. You are held accountable for all information from each class session whether you are present or not. Please report your reasons for any absences to the instructor in writing. It is your responsibility to be on time for each class session. Please report your reasons for any tardiness to the instructor in writing.

**Assignments.** The assignments across the semester are intended to further your understandings of what it means to teach, learn, and assess mathematics in light of current reforms in mathematics education. All assignments are to be turned in to your instructor on time. **Late work will not be accepted for full credit.** If the student makes prior arrangements with the instructor, assignments turned in late will receive a 10% deduction from the grade per late day or any fraction thereof (including weekends and holidays).

Problem Set & Pedagogy Responses-flexible dates (20%)

Individual Student Assessment (30%)

Lesson Plan Summary Reports (30%)

Mathematics Content & Pedagogy Checkpoints (20%)

##### **A. Problem sets, reflections and postings (20%)**

Rich, meaningful, problem-based tasks will be assigned for each session. Students are expected to complete these problems before class and incorporate their thinking about strategies used to solve the problems in class discussion. Work on problem sets will be shared in class and on occasion may be collected and evaluated.

**Problem Sets:** Some class sessions will consist of working on problem sets and analyzing student work. Problem sets are to be completed before the related class session. Students are expected to analyze and reflect solution strategies and come to class prepared to participate

in the discussion.

**Reflections postings** Participants will write reflections on the problems encountered during the course. Participants will complete reflections and may choose the problems/tasks that interest them from those assigned during class. This writing should include three major parts: 1) a description of the problem and an example of the participants' thinking about that problem and multiple strategies; 2) a reflection on changes in the participant's own understanding and thinking with regard to that problem; and 3) related implications for teaching and learning in the K-8 setting. Problem sets and reflections will be assigned at relevant points throughout the semester.

### **B. Individual Student Assessment (30%) – Performance Based Assessment for the Course**

In order to plan effective instruction, you will need to know how to assess children's knowledge of mathematical concepts. One way to assess children's thinking is a diagnostic assessment. This assignment has two parts: (1) Design a plan for the assessment, assessing a specific mathematics topic using concrete, pictorial and abstract representations, (2) Conduct the assessment with a child and write a report describing the outcome of the assessment. Based upon feedback from the instructor on your plan, you may make modifications to the final plan and report. **(10% PLAN; 20% FINAL REPORT)**

### **C. Three Lesson Study Plan Summaries (30%)**

You are required to plan, teach, and complete a formal summary for three mathematics lessons during your field placement. The first lesson may be taught in a small group setting, while the other lesson must include the entire class. The format for designing your mathematics lessons is found in your PS Manual. Try to avoid the *overuse* of worksheets. Integrate the use of mathematics tools (manipulatives, calculators, computers) and representations (concrete, pictorial, symbolic) to provide children with an interactive, conceptually-based mathematics experience. The lesson plan summaries are a three-phase process: (1) Design the lesson plan, (2) Teach the lesson in your classroom, and (3) Collect and report evidence of student learning from the lesson in a reflection.

### **D. Mathematics Content & Pedagogy Checkpoints (20%)**

The Mathematics Content/Pedagogy Checkpoints will consist primarily of short responses that focus on mathematics content in the elementary grades, with some questions focusing on methodological content. Throughout the semester, brief content-specific assessment will assist you in reviewing important mathematics appropriate for the elementary grades.

## **VII. Evaluation Schema**

Determination of the Final Grade: Graduate Grading Scale

A	93%-100%	A-	90%-92%
B+	87%-89%	B	80%-86%
C	70%-79%	F	Below 70%

The mathematics education courses in GSE's Elementary Education Program integrate pedagogy and mathematics content appropriate for the elementary school grades. For students to earn a grade of A in the course, they must demonstrate excellence in *both* the pedagogical knowledge and the content knowledge of the mathematics appropriate at their level of teaching. Thus, the grading in the course is structured to help evaluate fairly student excellence in both areas. Exam work focuses primarily on ascertaining student excellence in handling mathematics content appropriate for the elementary grades, and represents 50% of students' grades. Pedagogical knowledge is ascertained primarily from readings, assignments and participation in the course, and represents 50% of students' grades. Therefore students who demonstrate excellence in both pedagogical knowledge and content knowledge receive grades of A.

## **IX. Course Schedule**

Date	Topic/Learning Experiences	Readings from Van de Walle & Assignments due in class
Sept. 1	How Do Children Learn Mathematics? NCTM's Principles & Standards Math Philosophy	In-class Discussion Van de Walle: Chapters 1 & 2
Sept. 8	What is Problem Solving? A closer look at the MATH SOL NCTM PROCESS standards Lesson Study	<i>Chapter 3: Problem Solving</i> <i>Chapter 4: Planning in the Problem Based Classroom</i>
Sept. 15	Planning for Mathematics Instruction Number Sense, Counting, Patterns & Place Value/Basic Facts & Whole Number Operations	<i>Chapter 8: Early numbers</i> <i>Chapter 5: Assessment</i>
Sept. 22	Assessment – Conducting a Diagnostic Interview Numbers and operations In-Class Discussion of Lesson Plan #1 *Lesson Plan #1 DUE	<i>Chapter 9: Meanings for Operation</i> <i>Chapter 6: Equity</i>  <b><u>Lesson Plan #1 DUE today</u></b>
Sept. 29	Communication: Promoting Math talk <b>Mathematics Content &amp; Pedagogy Assessment</b>	<i>Chapter 11: Place value</i> <i>Chapter 12: whole number</i>
Oct. 6	Algebraic Thinking	<i>Chapter 13: Computation w/ Whole Numbers</i> <i>Chapter 14: Algebraic Thinking</i> <b><u>Individual Student Assessment PLAN DUE</u></b>
Oct. 13	Fractions	<i>Chapter 15: Fractions</i>
Oct. 20	No meeting: NCTM Regional Conference in Atlantic City <b>Mathematics Content &amp; Pedagogy Assessment Online</b>	
Oct. 27	Fraction Concepts and Computation Multiple Representations	<i>Chapter 16: Fractions Operations</i>
Nov. 3	Rational number concepts Lesson Plan #2 DUE (Share out)	<i>Chapter 17: Decimals percent</i> <b><u>Lesson Plan #2 DUE today</u></b>
Nov. 10	Proportional reasoning	<i>Chapter 18: Proportional reasoning</i>
Nov. 17	Measurement <b>Mathematics Content &amp; Pedagogy Assessment</b>	<i>Chapter 19: Measurement</i>
Nov. 24	No meeting: Thanksgiving	
Dec. 1	Geometry Lesson Plan #3 DUE (share out in class)	<i>Chapter 20: Geometry</i> <b><u>Lesson Plan #3 DUE today</u></b>
Dec. 8	Data Analysis Probability Experiments	<i>Chapter 21: Data Analysis</i> <i>Chapter 22: Probability</i>
Dec. 15	Individual Student Assessment Final REPORT DUE Panel Discussion	<b><u>Individual Student Assessment DUE</u></b> <i>Math Philosophy Revised</i>

## X. University Policies

### GSE Syllabus Statement of Expectations

A. The Graduate School of Education (GSE) expects that all students abide by the following: Students must adhere to the guidelines of the George Mason University Honor Code [See <http://academicintegrity.gmu.edu/honorcode/>].

**B.** Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu/>].

**C.** Students must follow the university policy for Responsible Use of Computing [See <http://universitypolicy.gmu.edu/1301gen.html>].

**D.** Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.

**E.** Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.

**F.** Students are expected to exhibit professional behaviors and dispositions at all times.

**CEHD Statement of Campus Resources:**

**A.** The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu/>].

**B** The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See <http://writingcenter.gmu.edu/>].

For additional information on the College of Education and Human Development, Graduate School of Education, please visit our website [See <http://gse.gmu.edu/>].

**RUBRIC FOR ASSESSMENT REPORT**

Criteria	Exceeds Requirements (A)	Meets Requirements (A-,B+,B)	Needs Improvement (C)	Inc.	Weight
Is the required information present about the <u>child</u> assessed?	5 In addition to the required information, the Report includes information about the child's performance in other academic, social, or behavioral areas. Cite references.	4 3 2 The Report includes the child's grade level, age, gender, race, academic ability level, and the child's level of understanding about the mathematics concept.	1 One or more of the required descriptive items about the child is missing.	0	x .05 =
Has the teacher selected one specific mathematics <u>concept</u> and assessed the concept using three different <u>forms of representation</u> (concrete, pictorial, abstract)?	5 Information on age-appropriate variations of the mathematics concept was gathered in preparation for the assessment. One math concept is clearly described and mathematically accurate. Three different forms of representation, with different examples in each form, are designed for use in interesting and creative ways. Connections are made among representational forms. Cite references.	4 3 2 One age-appropriate mathematics concept is selected, mathematically accurate, and clearly described. Three different forms of representation are described and used appropriately to assess the mathematics concept. Different examples may be used within each representational form.	1 One or more mathematics concepts are selected. They may not be age-appropriate. The Report is missing one or more forms of representation.	0	x .10 =
Do the <u>tasks and questions</u> match the specific mathematics concept being assessed? Is there variety in the tasks and questions used for each of the three different forms of representation?	5 In addition to the tasks/questions being aligned with the math concept, there are questions that differentiate and provide extensions for different levels of student performance. In addition to the variety of tasks/questions for each of the three forms of representation, tasks that show creativity and will be motivating for a child are included. Cite references.	4 3 2 The tasks and questions designed for the assessment are aligned with the mathematics concept being assessed. There are a variety of tasks and questions for each of the three forms of representation.	1 The tasks and questions designed for the assessment are not clearly aligned with the mathematics concept being assessed. The Report is missing tasks/questions that address one or more of the forms of representation.	0	x .15 =
Are the child's <u>work samples</u> included with three different forms of representation present in the work samples?	5 In addition to the variety of work samples from the child showing examples in each of the three forms of representation, a creative way of providing an explanatory overview of the child's work is included.	4 3 2 There are a variety of work samples from the child included showing examples in each of the three forms of representation. (concrete, pictorial, abstract)	1 There is only one work sample in each of the three forms of representation or work samples from one form of representation are missing.	0	x .10 =
Is the required question and response assessment <u>excerpts</u> present?	5 The Report includes key excerpts from the mathematics assessment that includes descriptive information on both the behaviors and the actual verbalizations that occurred during the assessment.	4 3 2 The Report includes excerpts of the mathematics assessment using the teacher and the child's actual verbalizations from the assessment (T for teacher; C for child).	1 The Report includes excerpts of the mathematics assessment, but some parts of the assessment conversation are limited.	0	x .15 =
Do the initial and follow-up <u>questions</u> used by the teacher demonstrate variety and higher levels of questioning? Are specific follow-up questions used appropriately?	5 The transcript shows that during the assessment, the teacher used a variety of questions to encourage the child to express his/her thinking, used many higher-level questions to encourage deeper thinking and responses from the child, and used specific follow-up questions to probe for understanding.	4 3 2 The transcript shows that during the assessment, the teacher used a variety of higher-level questions to encourage deeper thinking and appropriate follow-up questions to probe for understanding.	1 The transcript shows that during the assessment, the teacher used very few probing and follow-up questions when a specific follow-up question would have been appropriate.	0	x .10 =
Does the <u>evaluation</u> accurately represent the child's current level of understanding on this concept using supporting evidence and work samples from the assessment?	5 The evaluation provides an accurate and detailed description of the child's current level of understanding on the concept. Many different and specific examples from the assessment are given, including the child's quotations, student work, and information from other sources on math development, to provide supporting evidence for the evaluation of the child.	4 3 2 The evaluation provides an accurate description of the child's current level of understanding on the mathematics concept. Different examples from the assessment are given, including the child's quotations and student work, to provide supporting evidence for the evaluation.	1 The evaluation provides a minimal description of the child's understanding on the mathematics concept. A few examples from the assessment are given, but there is not enough information to provide supporting evidence for the evaluation.	0	x .15 =
Does the <u>instructional plan</u> prescribe developmentally appropriate next steps for instruction and take into account the child's current level of understanding on this concept?	5 The plan is a creative, detailed description of developmentally appropriate next steps for instruction taking into account the child's current level of understanding. The plan identifies many specific examples of activities and tasks that would further enhance this child's knowledge of this concept. Information from other sources on math development and child development was used. Cite references.	4 3 2 The instructional plan describes developmentally appropriate next steps for instruction. The plan identifies several specific examples of tasks that would be appropriate to further enhance this child's knowledge on this concept. The plan describes these tasks in relation to the child's current level of understanding.	1 The plan describes some next steps for instruction that may not be developmentally appropriate. The plan gives general (rather than specific) examples of activities and tasks for the child. The tasks may not be appropriate either for the child or the development of the math.	0	x .10 =
Is there an appropriate <u>reflection</u> and evaluation of the assessment process?	5 In addition to the required information, the Report includes a detailed analysis, self-reflection, and self-evaluation of the assessment process.	4 3 2 The Report includes a reflection and evaluation on the assessment process including the required elements.	1 The Report does not include one or more of the required elements for the reflection.	0	x .10 =
<b>TOTAL SCORE</b>					
<b>A</b>	<b>5.0 – 4.5</b>				
<b>A-</b>	<b>4.49 – 3.5</b>				
<b>B+</b>	<b>3.49 – 2.5</b>				
<b>B</b>	<b>2.49 – 2.0</b>				
<b>C</b>	<b>1.99 – 1.0</b>				
<b>Unsatisfactory</b>	<b>0.99 or below</b>				

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