George Mason University
EDCI 552-621: MATH METHODS FOR THE ELEMENTARY CLASSROOM
3 Credits Spring 2012

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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: Teach for America/George Mason University Elementary Cohort

II. Course Learning 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 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.

III. Relationship of Course Learning Outcomes to Selected National Professional Association Standards

Course Student Outcomes (above)	NCTM Principles and Standards	ISTE NETS	ACEI
A	S1, S2, S3, S4, S5	S1	1.0
B	S10	S2	3.1
C	P1, P2, P3, P4, P6	S2	1.0, 2.3, 3.1, 3.3, 3.4
D	P5	S2	4.0
E	S1, S2, S3, S5, S6		2.3
F	S1-10, P1-6	S5	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 2008, 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 give you 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
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).

Class participation (10%)
Problem Sets, Reflections, and Postings (10%)
Pedagogy Checkpoints (10%)
Lesson Plan Summary Reports (30%)
Individual Student Assessment (40%) **(PROBLEM-BASED ASSESSMENT)**

A. Class Participation (10%)

Attendance. It is your responsibility to attend and participate in 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.

Participation. In order to get the most out of this class, participants should complete the assigned readings, approach math problems and activities with perseverance and a positive attitude, and fully participate in class activities and discussions.

Use of Electronic Devices during Class. If you use an electronic device during class (laptop computer, tablet, phone, etc.) please be respectful of your peers and your instructor and do not engage in activities that are unrelated to class (i.e. email, text, chat, social networking, etc). Such disruptions show a lack of professionalism and will affect your participation grade.

The rubric for class participation is available on Blackboard.

B. Problem sets, reflections and postings (10%)
Rich, meaningful, problem-based tasks will be assigned during each session. Students are expected to complete these problems in 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.

Reflections postings Participants will write reflections on **any two problems** encountered during the course and **respond to two postings** from other students. 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. Postings will be shared on Blackboard, and participants are expected to read and comment on at least two entries by other students.

C. Pedagogy Checkpoints (10%)
The Pedagogy Checkpoints will consist primarily of short responses that focus on methodological content. The purpose is to help participants internalize pedagogy that leads to mathematical understanding and to begin to develop a problem-solving approach to teaching mathematics.

D. Lesson Plan Summaries (30%)
You are required to plan, teach, and complete a formal summary for **two mathematics lessons** you teach during this course. 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 should focus on the five strategies for facilitating mathematical discussion. Templates and rubrics for these assignments are posted on Blackboard.

E. Individual Student Assessment (40%) – 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. Based upon feedback from the instructor on your plan, you may make modifications to the final plan. (2) Conduct the assessment with a child and write a report describing the outcome of the assessment and create an instructional plan for the student.

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. Work that focuses primarily on ascertaining student excellence in handling mathematics content appropriate for the elementary grades represents 30% of students' grades. Pedagogical knowledge is ascertained

primarily from readings, assignments and participation in the course, and represents 70% of students' grades.

VIII. George Mason University Policies and Resources for Students

A. Academic integrity (honor code, plagiarism): Students must adhere to guidelines of the George Mason University Honor Code [See http://academicintegrity.gmu.edu/honorcode/].
B. Mason Email: 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, division, and program will be sent to students solely through their Mason email account. Students must follow the university policy for Responsible Use of Computing [See http://universitypolicy.gmu.edu/1301ge.html].
C. Counseling and Psychological Services: 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/].
D. Office of Disability Services: 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 http://ods.gmu.edu/].
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. The Writing Center (Optional Resource): 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/].
G. University Libraries (Optional Resource): The George Mason University Libraries provide numerous services, research tools, and help with using the library resources [See http://library.gmu.edu/].
H. Core Values Commitment: The College of Education and Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles. More information can be found at the Graduate School of Education's website.

IX. Course Schedule

Date		Topic/Learning Experiences	Readings from Van de Walle & Assignments due in class
Jan. 25		How Do Children Learn Mathematics? What is Problem Solving? NCTM's Principles & Standards Five Strategies for Facilitating Mathematical Discussions **Workshop: Reflections on your beliefs and experiences related to teaching and learning mathematics.**	Van de Walle: *Chapter 1: Teaching Mathematics in the Era of the NCTM Standards* *Chapter 2: Knowing and Doing Mathematics* *Chapter 3: Teaching through Problem Solving* *Chapter 4: Planning Instruction*
Feb. 1		Supporting second language and special education students Formative Assessment Conducting a Diagnostic Interview **Workshop: Begin planning student assessment. Read ahead in Van de Walle for ideas for activities.**	*Chapter 5: Assessment* *Chapter 6: Equity* *Chapter 7: Teaching with Technology* *Chapter 8: Early numbers* *Chapter 11:Place Value*
Feb. 8		Developing number sense and computational fluency **Workshop: Choose a computation topic relevant to your teaching context and plan a problem-based lesson. Plan to use the five strategies for facilitating discussion.**	***Choose two chapters most relevant to your grade level:*** *Chapter 9: Meanings for Operation* *Chapter 10: Basic Facts* *Chapter 12: Whole-number Computation* *Chapter 13: Whole-number Estimation* **Student assessment plan due. Turn in a hard copy in class.**
Feb. 15		Fraction concepts and computation **Workshop: Complete Pedagogy Checkpoint during class.**	***Choose two chapters most relevant to your grade level:*** *Chapter 15: Fraction Concepts* *Chapter 16: Fraction Computation* *Chapter 17: Decimal and Percent Concepts* **Lesson Summary 1 due to Blackboard by the end of the day.**
Feb. 22		Algebraic Thinking: More than x and y **Workshop: In a small group plan an upcoming unit or assess recent student work.**	*Chapter 14: Algebraic Thinking* *Chapter 18: Proportional reasoning*
Feb. 29		Geometry and measurement **Workshop: Complete Pedagogy Checkpoint during class.**	*Chapter 19: Measurement* *Chapter 20: Geometry*
Mar. 7 5:00-7:00		Working with data, graphs, and probability **Workshop: Reflect on your learning during this course and set at least one goal for the rest of this school year.**	*Chapter 21: Data analysis* *Chapter 22: Probability* **Lesson Summary 2 due to Blackboard by the end of the day.**
Monday Mar. 19			**Student assessment project due to Blackboard by the end of the day.**

Approved March 2004, Revised January 2012

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 child 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 concept and assessed the concept using three different forms of representation (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 tasks and questions 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 work samples 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 excerpts 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 questions 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 evaluation 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 instructional plan 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 reflection 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 =
TOTAL SCORE					

A	**5.0 – 4.5**
A-	**4.49 – 3.5**
B+	**3.49 – 2.5**
B	**2.49 – 2.0**
C	**1.99 – 1.0**
Unsatisfactory	**0.99 or below**