

GEORGE MASON UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT
GRADUATE SCHOOL OF EDUCATION
Elementary Education

EDCI 552 003: Math Methods for the Elementary Classroom
3 Credits, Fall 2014
9:00-11:40 a.m./Tuesdays Thompson L014

PROFESSOR(S):

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COURSE DESCRIPTION:

A. Prerequisites/Corequisites

Admission to the elementary education licensure program

B. University Catalog Course Description

Introduces methods for teaching all children topics in arithmetic, geometry, algebra, probability, and statistics in elementary grades. Focuses on using manipulatives and technologies to explore mathematics and solve problems.

C. Expanded Course Description

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.

LEARNER OUTCOMES or OBJECTIVES:

This course is designed to 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 the learning progression in relation to the 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/>.

PROFESSIONAL STANDARDS (Interstate Teacher Assessment and Support Consortium (InTASC) & Association for Childhood Education International Elementary Education Standards (ACEI):

Course Student Outcomes (above)	INTASCstandard (2011)	ACEI
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A Essential math	#4	1.0
B Planning and Teaching using manipulatives	#7	3.1
C Instructional Strategies	#8	1.0, 2.3, 3.1, 3.3, 3.4
D Assessing	#6	4.0
E Problem Solving	#5	2.3
F Learner Development and understanding of Learning Progression	#2/#1	1.0

INTASCstandard (2011)
<p>Standard #4: Content Knowledge</p> <p>The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.</p>
<p>Standard #7: Planning for Instruction</p> <p>The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.</p>
<p>Standard #8: Instructional Strategies</p> <p>The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.</p>
<p>Standard #6: Assessment</p> <p>The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.</p>
<p>Standard #5: Application of Content</p> <p>The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and</p>

global issues.

Standard #1: Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences

The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Association for Childhood Education International Elementary Education Standards 2007

1.0 Development, Learning, and Motivation--Candidates know, understand, and use the major concepts, principles, theories, and research related to development of children and young adolescents to construct learning opportunities that support individual students' development, acquisition of knowledge, and motivation.

2.3 Mathematics—Candidates know, understand, and use the major concepts and procedures that define number and operations, algebra, geometry, measurement, and data analysis and probability. In doing so they consistently engage problem solving, reasoning and proof, communication, connections, and representation;

3.1 Integrating and applying knowledge for instruction—Candidates plan and implement instruction based on knowledge of students, learning theory, connections across the curriculum, curricular goals, and community;

3.5 Communication to foster collaboration—Candidates use their knowledge and understanding of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the elementary classroom.

4.0 Assessment for instruction—Candidates know, understand, and use formal and informal assessment strategies to plan, evaluate and strengthen instruction that will promote continuous intellectual, social, emotional, and physical development of each elementary student.

Course & PBA	INTASC	ACEI
552 Math Student Assessment Interview	#4 Content Knowledge #1 & #2 Learner Development & Differences #6 Assessment	1.0 Development 2.3 Math 3.1 Planning Instruction 3.5 Communication 4.0 Assessment

REQUIRED TEXTS:

Van De Walle, J., Karp, K. S., & Bay-Williams, J. M. (2012). *Elementary and Middle School Mathematics: Teaching Developmentally*. (8th edition) New York: Allyn & Bacon.

COURSE ASSIGNMENTS AND EXAMINATIONS:

1. Assignment descriptions:

A. Problem of the Day: Participation, , Critique, Presentation & Reflection (20%)

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

Participation: Each class sessions will consist of working on a rich problem and utilizing the following: practices for promoting productive mathematics disussions, differentiation, the NCTM Process Standards and the multiple representations utilized. Students are expected to analyze and reflect solution strategies and come to class prepared to participate in the discussion.

Critique: Participants will be responsible for reflecting and providing feedback on the problem of the day, in relation to one of the following areas: practices for promoting productive mathematics disussions, differentiation, the NCTM Process Standards and the multiple representations utilized. write reflections on the problems encountered during the course.

Presentation: Students will present one Problem of the Day in class in a small group setting. Resources will be provided for identifying the the problem. Students will need to think about and incorporate the following areas as they present their Problem of the Day: practices for promoting productive mathematics disussions, differentiation, the NCTM Process Standards and the

multiple representations utilized. Dates for the Problem of the Day presentations are:

September: 23, 30

October: 7, 21, 28

November: 4

Reflection: Participants will write reflections on their presentation of the Problem of the Day. This writing should include three major parts: 1) a description of the problem, the mathematics involved and an example of the participants' thinking about that problem and presenting multiple strategies and solutions; 2) a reflection on changes in the participant's own understanding and thinking with regard to that math concept/problem; and 3) related implications for teaching and learning in the K-8 setting.

B. Individual Student Assessment (30%) Course Performance Based Assessment

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. **(30% FINAL REPORT)**

C. Two Problem-based Lesson Study Plan Summaries (30%)

You are required to plan, teach, and complete a formal summary for two 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. 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. Submit a short video-clip of your lesson, specifically, the launch, explore and summarize(discussion) phases with a formal observation feedback from a CF, SF, UF or instructor.

D. Mathematics Curriculum and Assessment Analysis (20%)

The **Mathematics Curriculum and Assessment Analysis** will consist primarily of practiced based skills that focus on mathematics content in the elementary grades, such as creating an open-ended assessment, error analysis, analyzing cognitive demand of a task, evaluating instructional materials, and determining how to assess student understanding of mathematical concepts. Throughout the semester, brief

content-specific assessment will assist you in reviewing important mathematics appropriate for the elementary grades.

2. Assignment and examination weighting

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 of the Day & Reflective Response (20%)

Individual Student Assessment (30%)

Lesson Plan Summary Reports (30%)

Mathematics Content & Pedagogy Assessment (20%)

3. Grading policies

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. Problem sets and assessment 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.

At George Mason University course work is measured in terms of quantity and quality. A credit normally represents one hour per week of lecture or recitation or not fewer than two hours per week of laboratory work throughout a semester. The number of credits is a measure of quantity. The grade is a measure of quality. The university-wide system for grading graduate courses is as follows:

Grade	GRADING	Grade Points	Interpretation
A+	=100	4.00	Represents mastery of the subject through effort beyond basic requirements
A	94-99	4.00	

A-	90-93	3.67	
B+	85-89	3.33	Reflects an understanding of and the ability to apply theories and principles at a basic level
B	80-84	3.00	
C*	70-79	2.00	Denotes an unacceptable level of understanding and application of the basic elements of the course
F*	<69	0.00	

Note: "C" is not satisfactory for a licensure course

"F" does not meet requirements of the Graduate School of Education

4. Other expectations

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.

Tardiness: It is your responsibility to be on time for each class session. Please report your reasons for any tardiness to the instructor in writing.

	LEVEL OF PERFORMANCE			
ELEMENT	<i>Distinguished</i> (9 – 10 points)	<i>Proficient</i> (8 points)	<i>Basic</i> (6 - 7 points)	<i>Unsatisfactory</i> (1 - 5 points)
Attendance & Participation	The student attends all classes, is on time, is prepared and follows outlined procedures in case of absence. The student actively	The student attends all classes, is on time, is prepared and follows outlined procedures in case of absence; the student makes active contributions to	The student is on time, prepared for class, and participates in group and class discussions. The student attends all classes and if an	The student is late for class. Absences are not documented by following the procedures outlined in this section of the syllabus. The

	<p>participates and supports the members of the learning group and the members of the class. Presentations demonstrate a deep knowledge of student error patterns as well as implications for teaching.</p>	<p>the learning group and class. Presentations demonstrate sufficient knowledge of student error patterns as well as implications for teaching.</p>	<p>absence occurs, the procedure outlined in this section of the syllabus is followed. Presentations demonstrate minimal knowledge of student error patterns</p>	<p>student is not prepared for class and does not actively participate in discussions. Presentations are lacking knowledge of student error patterns and connections to teaching.</p>
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TASKSTREAM REQUIREMENTS

Every student registered for any Elementary Education course with a required performance-based assessment is required to submit this assessment, Individual Student Assessment, to TaskStream (regardless of whether a course is an elective, a onetime course or part of an undergraduate minor). Evaluation of the performance-based assessment by the course instructor will also be completed in TaskStream. Failure to submit the assessment to TaskStream will result in the course instructor reporting the course grade as Incomplete (IN). Unless the IN grade is changed upon completion of the required TaskStream submission, the IN will convert to an F nine weeks into the following semester.

GMU POLICIES AND RESOURCES FOR STUDENTS

- a. Students must adhere to the guidelines of the George Mason University Honor Code (See <http://oai.gmu.edu/the-mason-honor-code/>).
- b. Students must follow the university policy for Responsible Use of Computing (See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>).
- c. 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.

- d. 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/>).
- e. 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/>).
- f. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- g. 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/>).

PROFESSIONAL DISPOSITIONS

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

CORE VALUES COMMITMENT

The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: <http://cehd.gmu.edu/values/>.

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

PROPOSED CLASS SCHEDULE:

Date	Topic/Learning Experiences	Readings & Assignments Due In Class
August 26 th	How Do Children Learn Mathematics? NCTM's Principles & Standards	Chapter 1: Teaching Mathematics (SKIM) Chapter 2: Exploring Mathematics (SKIM) Chapter 6: Teaching Equitably (READ)
September 2 nd	No Class Meeting: Complete Online Module What is Problem Solving? Planning for Mathematics Instruction	Chapter 3: Problem Solving Chapter 4: Planning Problem Based Lessons
September 9 th	Assessment: Conducting a Diagnostic Interview Number Sense	Chapter 5 Assessment Chapter 8: Early Number Concepts ONLINE MODULE DUE
September 16 th	Counting and Patterns Basic Facts Understanding Place Value	Chapter 9: Meanings for Operation Chapter 10: Basic Facts Chapter 11: Place Value
September 23 rd	Developing Student Strategies for Addition and Subtraction	Chapter 12: Addition and Subtraction
September 30 th	Developing Student Strategies for Multiplication and Division	Chapter 13: Multiplication and Division <u>Individual Student Assessment PLAN DUE</u>
October 7 th	Developing Fraction Sense	Chapter 15: Fractions
October 14 th	NO CLASS MEETING (Columbus Day Recess)	VDOE Scavenger Hunt
October 21 st	Strategies for Fraction Computation In-Class Discussion of Lesson Plan #1	Chapter 16: Fraction Computation Lesson Plan #1 Summary Due

October 28 th	Developing Concepts of Decimals and Percent	Chapter 17: Decimals and Percent
November 4 th	Proportional Reasoning	Chapter 18: Proportional reasoning
November 11 th	Measurement	Chapter 19: Measurement Final POD Reflection Due
November 18 th	Geometry	Chapter 20: Geometry
November 25 th	Algebraic Thinking Data Analysis In-Class Discussion of Lesson Plan #2	Chapter 14: Algebraic Thinking Chapter 21: Data Analysis Lesson Plan #2 Summary Due
December 2 nd	Algebraic Thinking Probability Experiments	Chapter 22: Probability
December 9 th	Integers Panel Discussion	Chapter 23: Integers <u>Individual Student Assessment DUE</u>

ASSESSMENT RUBRIC(S):

Below is the rubric for the performance based assessment for EDCI 552, the Student Assessment Interview.

Criteria	Exceeds Requirements (A)	Meets Requirements (A-,B+,B)	Needs Improvement (C)	Inc.	
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	
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	
Do the <u>tasks and questions</u> match the specific mathematics concept being	5 In addition to the tasks/questions being aligned with the math concept, there are questions that	4 3 2 The tasks and questions designed for the assessment are aligned with the	1 The tasks and questions designed for the assessment are	0	

assessed? Is there variety in the tasks and questions used for each of the three different forms of representation?	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.	mathematics concept being assessed. There are a variety of tasks and questions for each of the three forms of representation.	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.		
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	
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	
Do the initial and follow-up <u>questions</u> used by the teacher demonstrate variety and higher levels of	5 The transcript shows that during the assessment, the teacher used a variety of questions to encourage the child to express his/her	4 3 2 The transcript shows that during the assessment, the teacher used a variety of higher-level	1 The transcript shows that during the assessment, the teacher used very few probing	0	

<p>questioning? Are specific follow-up questions used appropriately?</p>	<p>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.</p>	<p>questions to encourage deeper thinking and appropriate follow-up questions to probe for understanding.</p>	<p>and follow-up questions when a specific follow-up question would have been appropriate.</p>		
<p>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?</p>	<p style="text-align: center;">5</p> <p>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.</p>	<p style="text-align: center;">4 3 2</p> <p>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.</p>	<p style="text-align: center;">1</p> <p>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.</p>	<p style="text-align: center;">0</p>	
<p>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?</p>	<p style="text-align: center;">5</p> <p>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</p>	<p style="text-align: center;">4 3 2</p> <p>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</p>	<p style="text-align: center;">1</p> <p>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</p>	<p style="text-align: center;">0</p>	

	sources on math development and child development was used. Cite references.	tasks in relation to the child's current level of understanding.	either for the child or the development of the math.		
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	