

EMAT 3400
Course Overview

Children's Mathematical Learning

Fall 2009

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Bulletin Description

Children's mathematical learning from pre-numerical stages through the acquisition of advanced numerical and spatial processes and operations. Research-based development of a theory of children's learning. Includes field component.

Overview of EMAT 3400 in the EDEC Program

Your preparation for teaching elementary school mathematics includes two EMAT courses. In this first course, we will focus on the child's mathematical development related to whole numbers, fractions, and decimals, with connections to early algebraic thinking. We will examine teaching strategies that reflect appropriate theory and practice from mathematics, developmental psychology, and pedagogy. The fundamental guiding perspectives will emphasize how children can construct numerical knowledge for quantitative reasoning that provides a solid preparation for success in algebra and beyond. Both NCTM Principles and Standards for School Mathematics and the Georgia Performance Standards [[http:// www.georgiastandards.org/Standards/Pages/BrowseStandards/MathStandardsK-5.aspx](http://www.georgiastandards.org/Standards/Pages/BrowseStandards/MathStandardsK-5.aspx)] will serve as the guiding curricular frameworks. We will complete 8 Wednesday sessions in which we will engage students from Barrow Elementary School in mathematical activities and experiences.

Course Goals & Objectives

1. To deepen your understanding of why and how we can teach in ways that allow our students to experience the meaning, power, beauty, and usefulness of mathematics.
2. To provide you experiences in conceptual analysis to support the development of children's mathematical thinking.

3. To investigate problematic situations in which the mathematical reasoning can be used to interpret, analyze, conclude or predict, generalize, and understand more deeply the problem being investigated.
4. To learn about resources and tools that can be used to support children's explorations of mathematical ideas and processes that can lead to deep conceptual understandings.
5. To develop ideas and beliefs about teaching methods that will support learning activities where our students are actively exploring and using mathematics.
6. To collect and develop problematic situations and related materials that we can take into our mathematics classrooms.

Starting Premises & Assumptions

While the central emphasis will be to help you engage in conceptual analysis of the major content ideas of elementary mathematics, we will seek to make connections throughout to the Georgia Performance Standards for Grades K-5 mathematics.

In the K-12 mathematics curriculum, the GPS emphasizes that students will---

- develop mathematical understanding
- use “manipulatives” and a variety of representations
- work independently and cooperatively to solve problems
- estimate and compute efficiently
- conduct investigations and record findings
- apply concepts and skills in authentic problems
- understand concepts rather than perform procedures
- think critically in a mathematical way
- understand different ways to solve & sometimes more than one answer
- know some ideas well & be able to reason
- make connections and be able to communicate

These are pedagogical perspectives that we will take as fundamental assumptions:

1. We need to reform school mathematics to emphasize greater understanding by our students of their mathematics and its usefulness--“...but, why do I have to learn this?”
2. Young mathematics students can engage in deeper thinking & reasoning than is typically expected or allowed, if they are motivated and supported to do so--“Wow, I got it!”
3. If approached effectively, applied “real world” situations where mathematics is used will be more appealing and interesting to students--“Where in the world will I ever use this?”
4. Students need to be actively involved in “doing” significant mathematics---A Chinese proverb: “I hear and I forget, I see and I remember, I do and I understand.”
5. Being generative is the essence of being knowledgeable, & we must help our student to learn to be more self-regulative & generative--Piaget: “To invent and discover is to understand.”
6. Cooperative mathematical activity in various groupings can facilitate student investigations and problem solving--“I can learn from others, too, if I listen and watch and share.”

7. A teacher's expectations, made clear to students, can greatly affect student effort and productivity---"*If we want more, we have to expect more--of ourselves and each other.*"
8. Interpersonal relationships among students and teacher are a critical aspect of "life in classrooms," and teachers must be alert to personality and relationship factors----"*Am I relating in positive ways, are my relationships healthy & balanced, & am I fostering these among students?*"
9. Modern technology tools must be accepted and used routinely in the mathematics classroom to further goals and activities where students actively explore and investigate their mathematics----"*What if....?*"
10. Modern school mathematics must include varied experiences with data (statistics), chance (probability), quantitative reasoning (numbers & operations), patterns (sequences), scales, rates and comparisons (ratio & proportion), change (variables & expressions), growth & decay (functions), size & location (geometry & measurement)---"*Mathematics is a rich tapestry of ideas and processes, a playground of abstraction and generality.*"
11. Factors related to cognitive and emotional development of students suggest structured play and "hands-on" explorations are essential foundations to abstracting and generalizing for building personal and shared theories of mathematics---"*The art of teaching is in the act of discovery*" (Polya).

Learning & Teaching Activities

The activities in our course are chosen to support your attainment of the course goals and objectives.

General Expectations

1. With your entry to this teacher education program, the Mathematics Education faculty considers you to be a novice teacher. You have made a commitment to, and have now entered, the education profession. As such, you should conduct yourself at all times in a **professional manner**.
2. **Attendance and punctuality are required**, since much of the value of the course will be through the experiences that occur during our class sessions. You must be present to learn, and to contribute to the learning of others. If you must be absent, please try to notify me in advance. If that is not possible, please send an email or talk with me as you can. As per UGA policies, more than four (4) unexcused absences can result in being administratively withdrawn from the course. All of this is especially critical during the eight Wednesday sessions with children at Barrow Elementary.
3. **Active participation** is expected, a critical assumption for learning anything more deeply. The pedagogy being advocated and modeled through our course is the belief that our students must commit to, and be involved actively in, the problems and situations being posed. Be involved. Developing collegial, supportive relationships is an important aspect of the teaching profession.
4. **Use of laptop computers** during class is allowed only for specific course-related activities (e.g., composing notes, examining GPS, using GSP, Excel or other mathematical tools). In general, you should not engage in web browsing, email, or other questionable unrelated activities during class time.
5. **Thorough preparation** for each class session is expected. The better-prepared one is for any experience, the more one will likely benefit from it. In particular, try to complete assigned readings and other activities before we will discuss them in class.
6. **Thoughtful reflection** following each course experience is expected. "Looking back" at one's experiences can help to review and consolidate what is important to remember.

Being reflective can help to sort out the “slag” or discards and find the “gems” to keep. At times, it can help one to evaluate ideas and feelings, and make needed changes. In general, a reflective person makes better choices and decisions.

7. **Deadlines** are goals, which can be altered, as we may need to do so. Flexibility is needed when dealing with humans, who differ in their needs in unique ways. If you need additional time that is reasonable and justified, please talk with me about it.
8. **High quality** is expected at all times. All participants should be expected to contribute and produce in very high quality ways, striving always to do the very best. This must be especially true of those who would choose to be a teacher of others!
9. **Find enjoyment** while you are growing as a teacher. Find positive energy in our course. If you have any, try to deal with your anxieties, fears, or negative feelings about mathematics. Strive to reach a new state of awareness, confidence, and peace, as you achieve one more step to become an outstanding school mathematics teacher!

Assessment Schedule

The course involves 3 assignments: (1) a portfolio (2) Barrow reports and (3) a final examination

(1) Course Portfolio

Essentially, the portfolio will consist of 4 components: (i) A journal of reflections (ii) A readings notebook, (iii) Mathematical and pedagogical activities and (iv) Mini-resource unit

(i) A “journal of reflections”

The purpose for engaging in reflective activity is to promote deeper, professional thinking. Research shows that one characteristic of the most effective teachers is that they are reflective practitioners - they intentionally and routinely think back over what they’ve experienced, in order to learn from it and to improve their own teaching. Therefore, each week from **August 17 through November 18**, you should write a “diary” or journal entry (1/2 to 1 page in length) to express your thoughts about your experiences (be sure to note the date with each entry). Some suggestions to guide you:

- By thoughtful. Think back to recall what you experienced.
- Do not write a “chronology of events” (i.e., what did we/you did).
- Rather, what were you thinking or feeling? What did you like or dislike?
- What were your reactions? What do you agree, or disagree, with?
- About what might you be unclear, confused, or have questions or concerns?

Your chronologically collected journal reflections will be in your course portfolio.

(ii) A “readings notebook”

Readings and activities will be assigned from the textbook (Reys, et al). A schedule for these assignments will be distributed. **For those specifically designated**, you will prepare a “readings notebook” entry. First, briefly identify and summarize those ideas that are important to you. Briefly discuss why you chose each, and how you might use the ideas in your mathematics teaching. All entries should be prepared neatly, using a word processor to be printed for placement in your course portfolio.

(iii) **Mathematical and pedagogical activities**

As a part of continuing professional learning, any teacher of mathematics must be ready to engage in personal mathematical activity that will strengthen one's own content background. Therefore, you will be engaged in a wide variety of mathematical situations that will be posed - all appropriate for use with elementary children (at some developmental stage).

- a. Sometimes, these will serve as “starting points” for you to engage in explorations and investigations with the goal of solving or making discoveries for yourself (such as “number cousins”).
- b. You will sometimes begin a posed situation by working in a group during class. All of these will promote firsthand experiences such as children might have.
- c. Sometimes you will be asked to develop further tasks, to give you experiences in formulating or extending situations for children.
- d. You will also be assigned some mathematical activities to be completed outside of class. Most of these can be done collaboratively; a few are to be done independently, on your own.

For each, you should document your efforts. In all cases, keep a record of your productions to be included in your course portfolio.

(iv) **Mini-resource unit - (designing materials for stimulating and guiding children's mathematics)**

To become an effective teacher, you must develop knowledge for designing, selecting and adapting appropriate situations for promoting children's mathematical learning and development. In each class, you will see, and engage in, mathematical tasks that I will pose, demonstrate, and discuss. You will learn to analyze the mathematical concepts, patterns, relationships, and procedures to “unpack” the essential meanings and processes involved. It is this analysis that we then use to conceptualize and design situations to pose to the child. Across several content topics, you will be assigned activities to help you learn to do this effectively.

You will be assigned to a “topic” to develop a “mini-unit” of situations and activities to address aspects of the GPS for that topic. Specific guidelines and directions for these materials will be provided. Specific details for writing the ‘mini-unit’ will be provided.

You will want to submit a neat, thorough, well-written, carefully organized portfolio. Your course portfolio will be assessed at the end of the term (to be returned to you). It will be due to be submitted at the beginning of our class on November, 30.

(2) **Barrow experiences and “activity reports”**

On eight Wednesdays (tentatively **September 23 through November 11**), we will meet at Barrow Elementary School. Further details will be provided.

- a. Your partner and you will submit a jointly written “**activity report**” related to your work with the children (**due before following Monday class**). Overall guidelines for preparing these

reports will be provided; specific directions related to particular sessions may also be given. These will be graded and returned to you.

b. You will separately prepare a final overall written “**Barrow individual activity report**” related to your experiences in the Barrow sessions. Again, specific directions for preparing that report will be provided (**due November 18**).

(3). **The final examination will involve 100 points.**

Components	Marks
1. Course Portfolio	
(i) Journal of reflections	50
(ii) Readings notebook	50
(iii) Mathematical and Pedagogical activities	50
(iv) Mini-resource unit	50
2. Barrow reports	
Barrow “activity reports” (8 x 20 pts)	160
Barrow “individual activity report”	40
3. Final examination	100
Total	500

Course grades will be based on total points earned (out of **500 possible points**), using a 90-80-70-60% scale to assign final letter grades.

All participants must complete a course evaluation at the end of the course.

Acknowledgement: This course was originally designed by Dr Larry Hatfield. I am thankful to him for allowing me to use his course materials.

Academic Honesty

The University of Georgia seeks to promote and ensure academic honesty and personal integrity among students and other members of the University community. In keeping with the University Honor Code and Academic Honesty Policy, each student is expected to do his/her academic work and to acknowledge fully and assistance and academic resources. All academic work must meet the standards contained in "A Culture of Honesty." All students are responsible to inform themselves about those standards before performing any academic work. Terms of this policy, resolution procedures, and consequences of violation are available at: http://www.uga.edu/honesty/ahpd/culture_honesty.htm

<p style="text-align: right;">August 17</p> <p>Introduction; Review of syllabus & calendar</p> <p>Aims of the course Perspectives on teaching children mathematics Georgia Performance Standards</p> <p>Chapters 1 & 2; Chapter 5***</p>		<p style="text-align: right;">August 19</p> <p>Building up early "number" concepts The young child's counting (actions on representations) Meanings: how many, successor, comparing Developing counting strategies & fluency Building up "units" & flexibility in naming & renaming Skip counting & patterns; constructing the number line</p> <p>Chapter 3 & 4; Chapter 7***</p>
<p style="text-align: right;">August 24</p> <p>Extending counting number concepts The system of "tens" units (place value) Becoming "playful with numbers": patterns, properties The system of "tens" units (place value) Composing/decomposing, reversibility Naming & renaming using symbols (expanded numerals) Becoming "playful with numbers:" patterns, properties</p> <p>"Number cousins," numeral puzzles</p> <p>Chapter 8</p>		<p style="text-align: right;">August 26</p> <p>Constructing Addition & Subtraction Children's strategies Helping to make computation meaningful Developing proficiency (effective, purposeful practice) Fundamental meanings (situations, representations) Reversible actions; links to counting; making a number line</p> <p>Chapter 9 (focus on addition and subtraction)</p>
<p style="text-align: right;">August 31</p> <p>Extending Addition and Subtraction</p> <p>Relations and properties Standard and alternative computational algorithms</p> <p>Chapter 11(pp. 237-248)</p>		<p style="text-align: right;">September 2</p> <p>Constructing Multiplication and Division Fundamental meanings (situations, representations) Developing proficiency (effective, purposeful practice) Relationships & properties</p> <p>Chapter 11 (pp. 248-257)</p>
<p style="text-align: right;">September 7</p> <p>Holiday (Labor Day)</p>		<p style="text-align: right;">September 9</p> <p>Extending multiplication and division Building up computation of products & quotients Basic facts; how 4 operations are connected Exploring relationships & properties Early algebraic reasoning; graphs (representations) Re-read Chapter 9 - focus on multiplication & division</p>
<p style="text-align: right;">September 14</p> <p>Number Patterns</p> <p>Types of numbers and number patterns Mental arithmetic and estimation</p>		<p style="text-align: right;">September 16</p> <p>Children's constructions of fraction reasoning Measurement leads to fractions; critical mental operations Key role of "one"; situations & interpretations Making & using fractions (modeling/representations)</p>

Chapters 10, 14, and 18 (selected part)		Chapter 12 (pp. 263-282)
September 21		September 23
Review and catch-up Chapter 6*** [Barrow preparations]		Barrow #1
September 28		September 30
Thinking with fractions (conceptual analyses) Role of counting; equivalence; comparing; number line Building up reasoning for sums & differences Representing & reasoning for products & quotients Chapter 12 (pp. 263-282) [Barrow preparations]		Barrow #2
October 5		October 7
Decimals and Decimal computation Decimal fractions lead to extending numeration Explaining decimal computation ("placing the point") Chapter 12 (pp. 282-289) [Barrow preparations]		Barrow #3
October 12		October 14
Building up ratio, proportion, and percent Situations using rates & comparisons Developing equivalence: many names for one ratio Chapter 13 [Barrow preparations]		Barrow #4
October 19		October 21
Building up ratio, proportion, and percent Chapter 13 [Barrow preparations]		Barrow #5
October 26		October 28
Building up geometry Geometric meanings: shape, size, position, motion, relations Chapter 15 [Barrow preparations]		Barrow #6
November 2		November 4
Building up geometry Chapter 15 [Barrow preparations]		Barrow #7
November 9		November 11
Building up measurement Measurement meanings: origin, unit, iteration, additive Chapter 16 [last Barrow preparation]		Barrow #8
November 16		November 18
Building up measurement Chapter 16		Connections: thinking with data Meanings: data sets, distributions, measures of

<p>Preparing for individual Barrow reflection</p>	<p>centrality (mean, median, mode), variation (deviation), inference Chapter 17 (pp. 382-402). Re-read Chapter 1*** & Chapter 2*** *** Individual Barrow reflection due ***</p>
<p style="text-align: right;">November 23</p> <p style="text-align: center;">Classes dismissed --- Holiday</p>	<p style="text-align: right;">November 25</p> <p style="text-align: center;">Classes dismissed --- Holiday</p>
<p style="text-align: right;">November 30</p> <p>Connections: thinking about chance Meanings: measure (number), ratio, 0-to-1, random, trials, theory vs experiment, error situations: coin, die, spinner, games, simulations Chapter 17 (pp. 402-409).</p>	<p style="text-align: right;">December 2</p> <p>Review</p>
<p>December 7 (last class session) Review</p>	<p>December 10 Final Exam</p>