

EMAT 6700

Advanced Explorations with Technology in Mathematics Instruction

Maymester 2007

[Dr. John Olive](#)

Classroom: Aderhold 111/113

Lab times: 8:00 a.m. - 11:00 a.m. M,T,W,Th,F

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[Class Members](#)

New Challenge!

This year we have a new challenge for students in EMAT 6700. During the past two years, the Georgia State Department of Education has begun implementation of the new [Georgia Performance Standards \(GPS\)](#) for mathematics in 6th and 7th grades. In the Fall of 2007, the 8th grade standards will be implemented in Georgia middle schools. Beginning in the Fall of 2008 the new integrated mathematics curricula will begin being implemented with Math 1 in 9th grade classrooms. Math 2, 3 and 4 will follow in the Fall semesters of 2009, 2010 and 2011. These new GPS high school mathematics curricula provide an opportunity for radically changing (and, hopefully, improving) the mathematics preparation of all Georgia students.

The new challenge that I am proposing for students in EMAT 6700 is to develop web-based units of instruction for high-school mathematics teachers to use that will be exemplars of the integrated approach to mathematics that is the cornerstone of the new GPS. These units will be keyed to the appropriate GPS and (if approved) be linked as resources for teachers from the GPS web pages.

Course Description

This course was originally designed by Professor Jim Wilson as a follow-up course to EMAT 4680/6680 and EMAT 4690/6690. EMAT 6700 is an extension of the previous two courses. We will continue to develop more depth with the use of various software applications to engage in mathematical investigations, to organize pedagogical demonstrations, and to set up problem explorations, and we will continue to emphasize the development of material that might be used with middle and secondary school students and their teachers.

The change from EMAT 4680/6680 and 4690/6690 is that each student, or possibly pairs of students, in the course will select, develop, and carry out a major web-based project: An Exemplar Unit of an Integrated Approach to Mathematics Instruction at the middle or high school level.

The students will develop their project using appropriate technology and place it on their web page on the Mathematics Education server. The emphasis is on exploration of various mathematical contexts to learn mathematics, to pose problems and problem extensions, to solve problems, and to communicate mathematical demonstrations. Use of multiple technologies is encouraged and direct connection to the new Georgia Performance Standards in Mathematics is a requirement.

There will also be several readings from the current research literature on technology in mathematics education and an integrated approach to mathematics curricula. You will be asked to write brief reaction papers to these articles and be prepared to discuss issues raised in the articles during our class time and/or post your ideas to a web-based discussion group.

[Click here for details of the Major Project and grading criteria.](#)

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The following software will be available for use:

[The Geometer's Sketchpad, v. 4.06](#)

[Fathom v. 2.1](#)

Excel Spreadsheet

Graphing Calculator 3.0

[Java MathWorlds](#)

[Java Bars](#)

Adobe PageMill 3.0 (for Web-page construction)

Netscape Composer (for web-page construction)

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Course Requirements.

Alert! As EMAT 6680 is a pre-requisite for this course, I am assuming that students will have prior experience with [The Geometer's Sketchpad](#) and [Fathom 2](#). I shall require all participants who do not already have copies to order student versions of these software.

Communication will be facilitated via e-mail and the course Home Page and each student should have an e-mail account.

Requirements for the Course

Attend classes as requested by the instructor.

Read and research the [Georgia Performance Standards for Mathematics](#) (GPS)

Engage in mathematical explorations using a variety of software tools.

Read and respond to articles provided by the instructor.

Develop a web-based unit to support implementation of the mathematics GPS. This must be carefully planned and approved by the instructor.

Objectives for the Course

To become familiar with the [Georgia Performance Standards for Mathematics](#) (GPS)

To become familiar with and operational on modern computer systems.

To use application software to solve mathematical problems.

To use application software to create mathematical demonstrations.

To use application software to construct new ideas of mathematics for yourself.

To engage in mathematical investigations using software applications.

To engage in some independent investigations of mathematical topics from the middle or secondary school curriculum or topics

appropriate for those levels keyed to the GPS.

To communicate mathematical ideas that arise from computer investigations using word processing and web technologies.

To communicate mathematical ideas via the computer applications.

To become familiar with recent issues in the literature regarding the use of technology in mathematics education.

To use general tools such as word processing, paint programs, web page construction and spread sheets to facilitate mathematical investigations and communication about mathematical investigations keyed to the appropriate GPS.

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[UGA Academic Honesty Policy](#)

The University of Georgia seeks to promote and ensure academic honesty and personal integrity among students and other members of the University Community. A policy on academic honesty has been developed to serve these goals. All members of the academic community are responsible for knowing the policy and procedures on academic honesty. Click on the link above to access the policy web page.

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Links to prior students' projects:

[Roy Jones, 2005](#)

[Michelle Greene and Cheryl Self, 2005](#)

[Katherine Huffman & Brooke Norman, 2005](#)

[Margaret Sloan, 2005](#)

[Mary Beth Wiggins, 2004](#)

[Kyungsoon Jeon and Larry Shook](#)

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Links to some web resources (these will be updated periodically, so check back often!)

[The Math Forum](#)

[MathTools](#)

[David Arnold's Introduction to Fathom](#)

[Links to On-line Data Sources \(for import to Fathom\)](#)

[Fathom Data Sets](#)

[Fathom Survey Login](#)

[Steve Benson's "Ways to Think About Mathematics"](#)

[Trigonometry at McCallie](#)

[Michael de Villiers' Web Page](#)

Web-based Applets

[JavaSketchpad Example \(Eccentric Conics\)](#)

[Alive Maths!](#)

[National Library of Virtual Manipulatives for Interactive Mathematics](#)

[NRICH Mathematics Entertainment Club](#)

[Physics Applets](#)

Logo Programming Languages

[Logo for Windows machines](#)

[StarLogo and Connected Mathematics](#)

State and National Curricula and Standards

[Georgia Performance Standards \(mathematics\)](#)

[UK National Curriculum in Mathematics](#)

[NCTM Principles and Standards Online](#)

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EMAT 6700 Students, Maymester, 2007

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GeorgiaStandards.Org One Stop Shop for Educators
GATEWAY TO EDUCATION & PROFESSIONAL RESOURCES

GPS WEBSITE FINDER

- [Monthly Resources](#)
- [Professional Learning](#)
- [Unit Design Builder](#)
- [Projects and Programs](#)
- [Partners in Education](#)
- [Online Teacher Resources](#)

CONTACT INFORMATION

[Math Staff Contacts](#)

For General Information:

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[Staff Contacts](#)

Help Desk
(Technical Assistance)
☎ (800) 869-1011

[Report Problems with this Page](#)

Mathematics Standards

Introduction to Mathematics Performance Standards

- [Executive Summary](#)
- [Math Frameworks](#)
- [Online Training, Phase III Day 1: 3-5](#)
- [GPS Training Materials](#)
- [Math Support Class](#)
- [Math GPS High School Research and Resource Manual](#)

Middle School Math Course Transition

- [GPS Course Transition](#)
- [Paths for GPS](#)

GPS Revisions

- [Mathematics Revisions Approved on 7/13/2006](#)

Grades K-5

- [Grades K-2 Mathematics Standards](#)
- [Grades 3-5 Mathematics Standards](#)

Grades 6-8

- [Grades 6-8 Mathematics Standards](#)

Grades 9-12

- [Mathematics 1](#)
- [Mathematics 2](#)
- [Mathematics 3](#)
- [Mathematics 4](#)

- [Core Mathematics 1](#)
- [Core Mathematics 2](#)
- [Core Mathematics 3](#)
- [Core Mathematics 4](#)

- [Accelerated Mathematics 1](#)
- [Accelerated Mathematics 2](#)
- [Accelerated Mathematics 3](#)

Major Project: Develop a web-based teaching resource package to support implementation of the middle or high-school GPS in mathematics

The major project is intended to allow you, individually or in pairs, to develop a complete teaching resource package for a unit to support implementation of a selected topic from the new [Georgia Performance Standards in Mathematics](#).

Complete, web-based teaching resource package

These web-based units will provide a comprehensive set of originally developed instructional materials that a middle or secondary teacher could use to teach an integrated mathematical topic keyed to appropriate GPS. The package should provide student materials, didactical rationales, and detailed guidelines related to all activities of student and teacher, including assessment and evaluation. Reflections from each member of the group should discuss connections, applications and impacts of your development experiences into future teaching practices.

Your project must make effective use of appropriate technologies and be accessible through the World-Wide-Web. The rationale for the choice of technologies must be clearly stated in the report.

Your report should also highlight the [NCTM Principles and Standards](#) as well as the Georgia Performance Standards (GPS) that are addressed through the activities in your resource package.

A major change in the new GPS is the nature of the courses in the

secondary school curriculum. All courses at the secondary level will be **INTEGRATED** mathematics courses (Math 1, 2, 3 & 4). Thus, I encourage you to develop a teaching resource package that integrates several mathematical topics.

Some possible broad topics

- Conic sections
- Physics/motion/vectors
- Optics
- Euclidean geometry
- Analytic/synthetic geometry
- Complex numbers
- Number theory
- Functions (inverse, identity)
- Social choice/voting systems
- Game theory
- Trigonometry
- Mathematical systems
- Matrices
- Sequences and Series
- Probability
- Geometric Probability
- Data and statistics

Some possible starting points

- Non-decimal bases and ancient numerical systems
- The algebra of modular arithmetic
- Patterns in repeating decimals
- Fibonacci sequences
- Golden ratio and the divine proportion (geometric, algebraic,

- applications)
- Pascal's triangle
 - Geometric and numerical relationships using areas and perimeters
 - The mathematics of Geographical Positioning Systems (GPS)
 - Exponential and logarithmic functions
 - The probabilities of winning the various Georgia Lotto games
 - SAT statistics by state
 - The Central Limit Theorem
 - A Fathom Survey

Only one final project report is required from each pair but individual reflections and summaries will be required from each member of the pair.

I suggest that the various components of the resource package be divided between the pair. It is very critical, however, that the pair develops an overall plan for the package before individuals start working on their respective parts. This overall plan needs to be included in the report. It will be necessary for each member of the pair to be aware of what the other member is developing throughout the process.

Resource packages must be mounted on each member's web page with links to appropriate files and resources. We shall also attempt to use the GPS web-based Unit Builder to mount your resource packages on the GPS Teacher Resources web site.

Each pair or individual will present their report during the exam period on Tuesday, June 5 from 8:00 a.m.-11:00 a.m.

Grading will be based on a total of 100 points.

- **Overall quality of the report --- 50 points** (assigned to both members of the pair)
 - Does it include all relevant aspects as listed above?
 - Is it well written?
 - Is it well organized?
 - Is it keyed to appropriate GPS and NCTM standards?
 - Does it demonstrate originality or creativity?
 - Did all members of the group contribute to the report?

Individual contributions to the report --- 20 points to each member

Individual reflections and summaries --- 10 points to each member

Presentation of the report --- 20 points to each member

- The presentation should be planned to last approximately 20 minutes
- Each member needs to take an active role in the presentation
- It should begin with a brief overview of the project
- **It should include a sample activity that involves the rest of the class in the use of technology**
- Implications for teaching the unit should be shared

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