

EMAT 6700

Advanced Explorations with Technology in Mathematics Instruction

Maymester 2006

[Dr. John Olive](#)

Classroom: Aderhold 111/113

Lab times: 8:00 a.m. - 10:45 a.m. M,T,W,Th,F

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Office hours by appointment

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[Class Members](#)

Course Description (freely adapted from Dr. Jim Wilson's Course).

This course was originally designed 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.

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.

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 issues of school mathematics instruction is expected.

There will also be several readings from the current research literature on technology in mathematics education. 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](#)

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! For those of you who have not yet taken EMAT 6680 or 6690, we shall introduce the basic (and some advanced) functions of the listed software during the first week of classes. I shall require all participants who do not already have copies to order student

versions of [The Geometer's Sketchpad](#) and [Fathom 2](#).

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.

Engage in mathematical explorations using a variety of software tools.

Read and respond to articles provided by the instructor.

Develop and carry out one major project. This must be carefully planned and approved by the instructor.

Objectives for the Course

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.

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.

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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.

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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](#)

[Marcia Bailey](#)

[Mary Eager](#)

[Kyungsoon Jeon and Larry Shook](#)

[Kelli Tysinger](#)

[Kursat Erbas](#)

[William Jackson](#)

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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 2006

[Maria Elizabeth Broder](#)

[Emily Price Kennedy](#)

[Natalie Rowe Minor](#)

[Nikhat Parveen](#)

[Laura Ann Trkovsky](#)

[Hamilton Hardison](#)

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Major Project

The major project is intended to allow you, individually or in pairs, to explore a specific topic in depth. Projects can be either a report of your joint mathematical investigations within your chosen topic or a complete teaching resource package for a unit on your chosen topic. The following descriptions are adapted from Dr. Hatfield's EMAT 4500/6500 course:

A: Report of your mathematical investigations

These papers will deal with your (or your pair's) own exploration of an approved mathematical problematic situation, chosen because it could potentially be developed with middle or secondary school students. It must be approached as an authentic investigation in which you search for patterns and relationships, formulate your own search path, make speculations and conjectures, develop possible generalizations, and seek justification and proof. The report should include reflections from each member of the group and a summary that discusses applications, connections within and outside of mathematics, and impacts of your experiences into your future teaching practices.

B: Complete teaching resource package

These reports will provide a comprehensive set of originally developed instructional materials that a middle or secondary teacher could use to teach an approved enrichment topic. 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.

Both types of projects must make effective use of appropriate technologies. The rationale for the choice of technologies must be clearly stated in the report.

Your report should also highlight the NCTM Principles and Standards AND the Georgia Performance Standards (GPS) that are addressed through the activities in your investigation or 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
- Non-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

- 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.

For type A reports, individual members should include their own particular conjectures, discoveries etc. A group summary should synthesize these various aspects of the mathematical investigation.

For type B reports I suggest that the various components of the course 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.

Reports must be mounted on each member's web page with links to appropriate files and resources.

Each pair or individual will present their report during the final class period on Tuesday, June 6 from 8:00 a.m.-10:45 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 mathematically sound?
- Does it make appropriate use of the technologies?
- 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
- A summary of findings (for type A projects) should be presented
- Implications for teaching the unit should be shared (for type B projects)
- Each member of the group should share brief reflections on their experiences

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This page uses [JavaSketchpad](#), a World-Wide-Web component of [The Geometer's Sketchpad](#).
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Sorry, this page requires a Java-compatible web browser.

eccentric_conics