

2008-2



EDUCATION 845
Learning mathematics with computers
(Enroll #6904)

Summer Semester 2008

Instructor: Dr. Nathalie Sinclair

Meeting Dates: June 13-15; June 27-29; July 7-11

Office: 8659

Times: 9:00 – 16:00 except June 13 and
27 17:00 – 21:00

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COURSE RATIONALE

Computer-based technology can offer radically new ways of representing and understanding mathematical concepts and problems. In the next decades, mathematics education will be transformed by the presence and use of technology. Teachers should gain awareness of the challenges and opportunities involved in implementing different types of technology in the context of their present and future curricula.

DESCRIPTION

This course presents students with mathematics problems, open-ended mathematics investigations, challenges to organize and communicate information from these investigations, and some technology tools to accomplish such tasks. The mathematics content is at the level of the junior and secondary school curriculum – which some exceptions. These include relations and their graphs, functions and their graphs, demonstration and proof, measurement, geometry of the plane, locus problems, conics, sequences, limits, polar equations, parametric equations, and three-dimensional surfaces.

The underlying psychological theme in the course is the use of **visual reasoning** in mathematical discourse. The technology tools are essential to enabling students to construct visual and symbolic representation of ideas and to incorporate these into their approaches and thinking about problems. The visualizations produced with the aid of technology are not the end product but rather a means to facilitate student's mental images that help them form, relate, and organize mathematical concepts.

GOALS AND LEARNING OUTCOMES

There are two broad goals for this course:

- (1) As learners, you will
- experience incorporating computers in mathematical problem solving
 - enrich personal repertoire of problems
 - become familiar with a variety of computer applications and applets appropriate for educational use
- (2) As teachers, you will
- become familiar with several research studies on incorporating computers and calculators in mathematics classroom
 - adapt and refine problems and materials to serve the needs of students and curriculum

REQUIRED TEXTS

Papert, S. (2003). *Mindstorms: Children, computers and powerful ideas*.
Basic Books, ISBN: 0465046746.

The Geometer's Sketchpad, Student version (software)
Emervilly, Key Curriculum Press, ISBN: 0471272922

ADDITIONAL RESOURCES

Additional articles to be provided by instructor. Students must have a computer with internet access to prepare assignments. It would be preferable if you could bring your laptops to each class.

GRADING

#1	Problem portfolio (individual)	25%
#2	Task design, analysis and presentation (in groups of 2)	25%
#3	Reviews of books and articles	25%
	Participation (in class and online)	25%

Problem Portfolio (individual)

Submit a “portfolio” of 3 problems that you have tackled with the help of technology. You may choose up to 2 problems that were introduced in class, and you must include at least 1 that you have posed or chosen yourself. Each problem should be “written up” to describe the processes that you underwent in trying to pose, solve and explain the problem. By “process” I do not mean a long list of the things you did “First I did this and then I did that...” Rather, I mean a more reflective, narrative explanation of the barriers you ran into, the insights you had, the way in which the software you used helped or detracted, and so on. I want to read a story of your time with the problem.

Your first entry will be due by June 26th. I will use this opportunity to provide you with feedback so that you can be in a better position to complete your remaining portfolio. The final portfolio will be due on July 16th.

Task design, analysis and presentation (in pairs)

This assignment will be due on July 8th. You will be asked to develop a technology-based task (using the technology of your choice) that you could actually implement in your classroom (though you are allowed to imagine the best of all worlds coming together on the day you implement!). This will include identifying or creating the appropriate digital representation (applet, sketch, calculator, etc.) as well as the appropriate student materials (worksheet, prompts, etc.) as well as your planning notes (this could be a lesson plan, but does not have to be). You will have the opportunity to try your task out in our course (please plan for around 45 minutes).

In addition to your presentation, and the teaching materials, you will also be asked to write an analysis of your task, taking into account the following issues: (1) how has the mathematical changed with the use of technology? (2) How have the questions, problems, examples, explanations changed with the use of technology? (3) What might your colleagues like about your task? (5) What might your colleagues criticize about your task?

In choosing a task to offer (whether it is a task you have found in other resources, or one that you have designed on your own), you should be clear about the grade level you intend it for, and the curriculum connections it might have. You should have some hypotheses about how we (the class) will respond to the task so that you reflect on the differences or surprises that might arise in your wrap-up.

Review of books and articles (individual)

You will be asked to read and respond to several articles (and one book) during the course. For each article, you will be asked to write a one-page reflection on the themes of the article and your critical interpretation of them. Your first book will be *Mindstorms*, and your reflections will be due on June 14th. Additional readings and reflection due dates will be given in class.