

DISCOVERING THE ART OF MATHEMATICS

The only way to learn mathematics is to do mathematics. - Paul Halmos



In keeping with the spirit of inquiry that underlies our project, we begin with a few questions. Please think about them. Some clues are contained within.

1. Nationally, what are the four largest college mathematics audiences?
2. Would you be willing, as a short term experiment, to turn control of your classroom over to a purely inquiry-based approach? What are your fears? What resources would make it possible for you to do this?
3. Do you think that your students see beauty in mathematics? For general education students, particularly Arts and Humanities students, is this important?

Continuing NSF Support Awarded to Discovering the Art of Mathematics

It is an honor to announce that Discovering the Art of Mathematics (DAoM) has been awarded a four year, \$550,000, Type 2 grant from the Transforming Undergraduate Education in Science Program (TUES) of the National Science Foundation (NSF) to continue our work on using Inquiry-Based Learning (IBL) in MLA courses. NSF received 330 Type 2 proposals and only awarded 32 of these proposals funding.

Originally supported by a Phase 1 TUES (nee CCLI) grant from NSF and a generous gift of Mr. Harry Lucas, Discovering the Art of Mathematics will continue its work on:

- Curriculum Materials - Including the completion of 10 stand alone, full-length (100 - 150 pages) inquiry-based learning guides each suitable for a semester-long MLA course.
- Teacher Resources - Designed to support the use of DAOM curriculum materials.
- Professional Development Workshops - To help other faculty incorporate inquiry-based learning and/or mathematical connections to the Arts and Humanities in their general education courses.
- Assessment and Evaluation - Measuring the impact of curriculum materials and inquiry-based pedagogy on student achievement and attitudes.

Discovering the Art of Mathematics Vision: Mathematics for Liberal Arts (MLA) students will be actively involved in authentic mathematical experiences that are both challenging and intellectually stimulating, that provide meaningful cognitive and metacognitive gains, and that nurture healthy and informed perceptions of mathematics, mathematical ways of thinking, and the ongoing impact of mathematics not only on STEM fields but also on the liberal arts and humanities.

“I have to admit, I have never had a class like this, where learning is the most important factor.” DAoM student

Curriculum Materials which make up the **Discovering the Art of Mathematics Library**.

Books in version 1.0 or beta - materials for at least a full semester course that are ready to beta test:

- The Infinite - 105 pages.
- Number Theory - 107 pages.
- Geometry - 98 pages.
- Knot Theory - 89 pages.

Books in alpha version - materials for at least a full semester course which can be beta tested with support:

- Music and Dance - 96 pages.
- Games and Puzzles - 148 pages.
- Patterns - 94 pages.
- Reasoning - 69 pages.

Books in development - not complete but two or more single chapters are ready to beta test:

- Art and Sculpture - 50 pages.
- Calculus - 29 pages.
- Student Toolbox - 33 pages.

All materials freely available from

<http://artofmathematics.westfield.ma.edu> .

For more information, please contact the DAoM team at artofmathematics@westfield.ma.edu



Anamorphic art by DAoM students.

Faculty IBL Workshops

Interested in involving your general education students more actively in the mathematics experience but not sure how to start? Need appropriate materials or maybe just some support? Interested in building a small community incorporating inquiry in their classes?

As part of Type 2 work DAoM will be offering traveling professional development workshops. DAoM will come to you to offer a two-day workshop. DAoM will provide \$200 stipends for participants, \$500 for a local organizer and travel costs to workshop leaders. All you need to do is gather a cohort of interested teachers (hopefully including some from two-year colleges, four-year colleges, and high schools), provide an appropriate location for the workshop and provide lunch for participants. Please contact DAoM if you are interested in hosting a workshop.



DAoM students investigating point projection.

“You know something I find strange? Sometimes I actually feel kind of smart mathematically. I’m not used to being able to comprehend or even work out problems in mathematics, and since this course, this new and strange phenomena has occurred.” DAoM student

New Partners

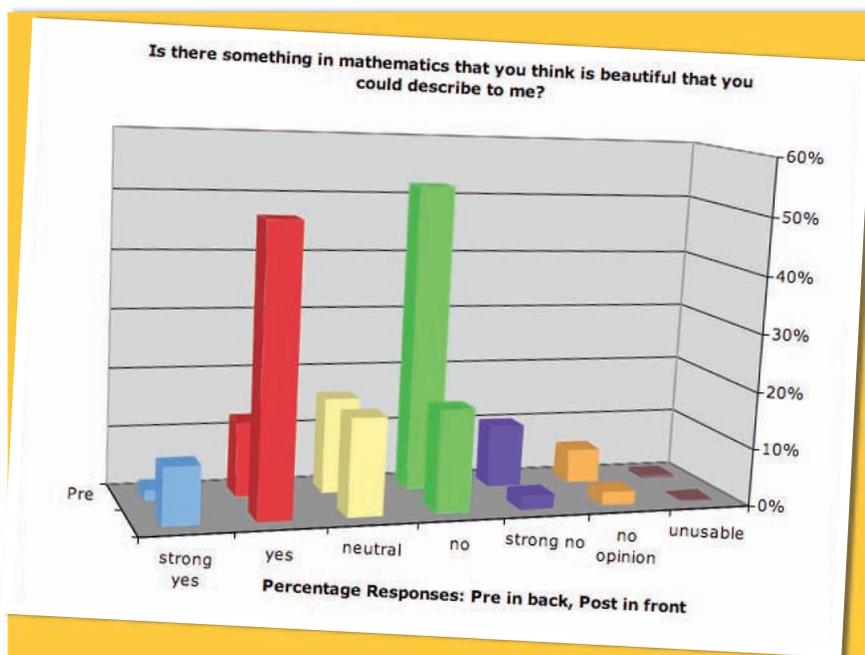
It is an honor to welcome our outstanding new Advisory Board:

- David Farmer, Director of Programming, American Institute of Mathematics.
- Jere Confrey, J.D. Moore Distinguished Professor of Mathematics Education, North Carolina State University.
- Sandra Laursen, Co-Director, Ethnography & Evaluation Research, University of Colorado at Boulder.
- Carmel Schettino, Ph.D. Candidate in Mathematics Education at State University of New York at Albany.
- Deborah Schifter, Principal Research Scientist at the Education Development Center (EDC).
- Dorothy Wallace, Professor of Mathematics, Dartmouth College.

DAoM also happily welcomes the SageFox Consulting Group of Amherst, MA who will be the project’s main assessment/evaluation team.

Recent publications inspired by materials appearing in DAoM materials:

- “Navigating Between the Dimensions,” Julian F. Fleron and Volker Ecke, *Mathematics Teacher*, Vol. 105, No. 4, November 2011, pp. Cover, 241, 243, 286-292.
- “Exploring 3D Worlds Using Google SketchUp,” Jenny Livingstone and Julian F. Fleron, *Mathematics Teacher*, Vol. 105, No. 6, February 2012, pp. 469-73.
- “Radon-Kaczmarz Puzzles: CAT Scans Meet Sudoku,” Julian F. Fleron, *Math Horizons*, February 2012, pp. 28-9.
- “Musical Palindromes for Liberal Arts Students,” Christine von Renesse, *PRIMUS*, forthcoming.



Clues

1. Mathematics for Liberal Arts is the fourth largest cohort of college mathematics students with over 180,000 students enrolled in 2005. (CBMS, 2007) This makes them a hugely important audience. You can likely guess the three larger ones. Compare the resources, energy and importance given to these other areas. Are those for MLA comparable?

2. Discovering the Art of Mathematics offers extensive curriculum materials that can be used to experiment with inquiry-based learning in MLA courses for a week, month, or complete semester. Use a book from the DAoM library, or test out a chapter, or even take a section to use as a test module. Our [Topic Index](#) cross references much of the materials with content areas typical in MLA.

Additionally, traveling professional development workshops can help build local networks of teachers to support each other in experimenting with inquiry-based learning.

3. With deep connections to the arts and humanities, Discovering the Art of Mathematics helps MLA students find beauty in the human endeavor that is mathematics. The results to the left are from $n > 500$ students who have used DAoM materials in their MLA courses.

PRIMUS Call for Papers and JMM Contributed Paper Session

DAoM is pleased to announce that its project team has been invited to serve as Guest Editors of a special edition of the journal *PRIMUS* whose topic will be “Using Inquiry-Based Learning in Mathematics for Liberal Arts.”

In preparation for this issue DAoM is chairing and PRIMUS is sponsoring the MAA Contributed Paper Session “Using Inquiry-Based Learning in Mathematics for Liberal Arts” at the Joint Mathematics Meetings in San Diego, CA this January. Please mark your calendars. Our session is on Friday, January 10 from 8:00 - 11 a.m. and 2:40 - 5:00 p.m.

The challenge is critical. As the Committee on the Undergraduate Program in Mathematics (MAA) tells us:

“College students study the best paintings, the most glorious music, the most influential philosophy, and the greatest literature of all time. Mathematics departments can compete on that elevated playing field by offering and making accessible to all students intriguing and powerful mathematical ideas... Indeed, these courses [general education and introductory mathematics courses] should be developed and offered with the philosophy that the mathematical component of every student’s education will contain some of the most profound and useful ideas that the student learns in college.” (2004, p. 28)

If you have approaches that help your students explore some of these most “profound and useful ideas,” please consider contributing a paper for potential inclusion in this issue.

Deadline for submission for the special issue of *PRIMUS* is March 15, 2013. A more formal call is forthcoming.

The Discovering the Art of Mathematics team is Julian F. Fleron, Volker Ecke, Christine von Renesse and Philip K. Hotchkiss.

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