

**Mathematics Department
Cornell University**



K-12 Education & Outreach Committee Report

August 2011 – July 2012

Committee Members

Dan Barbasch (Chair)
Robert Connelly
David Henderson
Mary Ann Huntley
Yulij Ilyashenko
Edward Swartz

Overview

During the 2011-2012 academic year the Mathematics Department continued its tradition of offering a wide variety of outreach activities. Most of these activities were led by faculty members, graduate students, and undergraduate students in Mathematics and the Center for Applied Mathematics (CAM). The outreach targets mathematics teachers and students at local schools at all grades, with primary emphasis on the secondary level (grades 7-12).

This report is organized around two major areas of focus – teacher development activities and outreach to the local community. Compared with past years, this year there has been increased attention on assessing the outreach activities and obtaining information about ways to improve the outreach activities. This information is included in the report.

A summary of the outreach activities that were offered over the past year is in Appendix A. Altogether, 68 people offered outreach activities that were sponsored by the Mathematics Department. An alphabetical list of these people is in Appendix B. Appendix C contains this list sorted by outreach activity.

The K-12 Education and Outreach Committee has put a proposal forward to the faculty in the Mathematics Department to establish two outreach awards. One award is for graduate students, and the other is for faculty. These awards will recognize the important contributions made by people in the Department to K-12 education and outreach to the local community. The faculty will vote on this proposal in Fall 2012.

Beginning in Fall 2012 there will be some major changes to mathematics education, both locally and nationally, that will affect our professional development offerings from the Mathematics Department. Ithaca City School District has adopted *Singapore Math* as its elementary school textbook series. The content and pedagogical approach of these books is quite different than the *Everyday Math* books that have been used by the district's teachers over the past several years. In addition, all grades K-12 New York State teachers, and teachers in most other states across the country, will begin implementing the *Common Core State Standards for Mathematics (CCSS-M)*.¹ For the 2011-12 school year, both instruction and assessments will remain focused on the New York State Learning Standards in Mathematics that were approved in 2005; however, it is expected that every teacher will implement at least one Common Core-aligned instructional unit this academic year. At the start of the 2012-13 school year, it is expected that all mathematics instruction will be aligned to the Common Core, and students will be assessed using tests that are aligned with the CCSS-M starting in the 2012-13 school year.

¹ http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf

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1. Teacher Development Activities

The Department of Mathematics and the Center for Applied Mathematics assists mathematics teachers and students at several local schools at all grades, with primary emphasis on the secondary level (grades 7-12). Faculty, graduate students, and undergraduate students participated in several teacher development activities over the past year. Each is described in more detail on the following pages.

A. MATH 5080: Mathematics for Secondary School Teachers

During the 2011-2012 academic year, the Mathematics Department hosted four full-day Saturday professional development workshops for secondary mathematics teachers. Attendance at the workshops ranged from 12-27 people per session. Over the course of the year, workshop participants included 46 people (22 teachers from 13 different schools, 18 faculty and students from two colleges/universities, and 6 others).

Table 1. MATH 5080 Attendees, 2011-2012

AFFILIATION	Number of Participants
Auburn High School	1
Chenango Valley High School	1
Cornell University	15
DeWitt Middle School	1
Fayetteville-Manlius High School	1
Ithaca College	3
Ithaca High School	4
Lansing Middle School	3
Math & Physics Exploration	2
Moravia High School	1
Parametric Technology Corporation	1
Retired (Ithaca High School)	1
Roland Park School (Baltimore)	1
Skaneateles High School	1
Susquehanna Valley Elementary School	1
Susquehanna Valley Middle School	2
TST BOCES	1
Union-Endicott High School	4
Waverly High School	1
Other (independent consultant)	1

At the April 21st workshop we celebrated David Henderson's contributions to mathematics education in general, and to the local mathematics education community in particular. Some photos from the event are below.



Severin Drix (Ithaca High School) with David Henderson



David Henderson with Eric Robinson (Ithaca College)



David Henderson with David Bock (retired, Ithaca HS, Cornell)



Dick Furnas (Cornell) with David Henderson

The syllabus and full agendas for the workshops are on the pages that follow. One presenter, Robert Morrison, graduated from Cornell University with a major in mathematics (Class of 1956).



Cornell University
K-12 Education and Outreach, Mathematics Department

MATH 5080

Mathematics for Secondary School Teachers
(aka “Saturday Workshops for Teachers”)

Fall 2011 – Spring 2012

Instructor Information

Dr. Mary Ann Huntley
Office: 216 Malott Hall
Phone: (607) 255-5529
E-Mail: huntley@math.cornell.edu

Course Information

Meeting Room: 406 Malott Hall
Meeting Time: 9 am - 2:30 pm
Meeting Dates
Fall 2011: Oct. 1 & Nov. 19
Spring 2012: to be determined

Course Overview

Since 1985, during each academic year the Cornell Mathematics Department has offered a series of four full-day workshops for secondary mathematics teachers. Other people who are interested in issues related to the teaching and learning of secondary mathematics (e.g., mathematics pre-service teachers, mathematics undergraduate and graduate students, and mathematicians) are also welcome to attend. During workshop sessions participants examine principles underlying the content of the secondary school mathematics curriculum, including connections with the history of mathematics, technology, and mathematics education research. Prior to each workshop a detailed agenda will be posted online (www.math.cornell.edu/Community/community.html). Participation at one workshop is not prerequisite to attending another.

Registration, Credit, and Costs

To register for a workshop, send e-mail to or phone the instructor indicating your interest. There are two options for receiving credit for MATH 5080.

1. Teachers may receive 1 Cornell University graduate credit for attending three of the four workshops offered during an academic year. This option entails registering for the course during the spring semester, which includes paying a \$100 registration fee and completing paperwork from the Office of Continuing Education.
2. Teachers qualify for 5½ in-service hours per workshop. For this option, there is no cost for attending the workshops.

Special Notes

Free parking on Saturdays is available on campus along Tower Road and also in the parking garage that is two blocks away from Malott Hall. (For more information about parking, please see: <http://www.transportation.cornell.edu/tms/cms/parking/maps>). Prior to any workshop meeting, please let the instructor know if you require any special accommodations.



Cornell University

K-12 Education and Outreach, Mathematics Department

MATH 5080

Mathematics for Secondary School Teachers

October 1, 2011

9:00 am – 2:30 pm

406 Malott Hall

8:45-9:00 **Welcome** (juice and bagels provided)

9:00-9:15 **Introductions**

9:15-12:00 **Getting a Grip on the Common Core State Standards for Mathematics**

Eric Robinson (Ithaca College) & Mary Ann Huntley (Cornell University)

Come learn more about the Common Core State Standards for Mathematics (CCSSM)! What is different about this set of standards compared with past reforms? Why is there so much excitement concerning the “Standards for Mathematical Practice?” What are some resources for implementing the CCSSM? What’s the buzz about the NYS assessments in 2014 that will be aligned with the CCSSM?

12:00-12:30 **Lunch** (provided)

12:30-1:30 **The Mathematics of Magic Tricks**

John Maceli (Ithaca College)

Many card tricks are based on properties of numbers. Several examples will be provided that you can try with your students.

1:30-2:30 **Fostering Collaborations between Local Mathematics Teachers and the Cornell Mathematics Department**

Mary Ann Huntley & Dan Barbasch (Cornell University)

This session will consist of a discussion between K-12 teachers and mathematicians about how to better target our outreach resources. We will solicit your ideas about ways we can collaborate and how our mutual interests can be met. Come share your views!

RSVP to Mary Ann Huntley by noon on Wed., Sept. 28th if you plan to attend.

E-mail: huntley@math.cornell.edu Phone: (607) 255-5529



Cornell University
K-12 Education and Outreach, Mathematics Department

MATH 5080

Mathematics for Secondary School Teachers
November 19, 2011
9:00 am – 2:30 pm
406 Malott Hall

8:45-9:00 **Welcome** (juice and bagels provided)

9:00-9:15 **Introductions**

9:15-11:00 **Digital Natives & the NTCM Communication Standards**
Chris Hartmann (PTC)

From their phones to their laptops, today's students (aka "Digital Natives") demonstrate facility using keyboards to communicate their ideas, their feelings, and their homework. Mathcad Prime, a whiteboard environment designed for scientific and mathematical communication, enables users to combine text, numeric and symbolic calculations, data tables, graphs, and symbolic tools in a single document. This hands-on workshop will focus on ideas for using Mathcad Prime to improve students' mathematical and scientific communication skills, as recommended in NCTM's *Principles and Standards for School Mathematics* (2000). What could your students do with a word processor that had a graphing calculator built into it? You will find out in this workshop!

11:00-12:15 **Allowing Children to Understand Math**
Irvin M. Miller & Robert L. Morrison (Math & Physics Exploration)

This session will focus on demonstrating how elementary mathematics lessons are intertwined with middle- and high-school topics. We will show how to introduce proofs and teach effective study and learning techniques. A mechanical implementation of the 3x3 magic square will be used as a model.

12:15-12:45 **Lunch** (provided)

12:45-2:15 **Reaching Recalcitrant High School Students**
Irvin M. Miller & Robert L. Morrison (Math & Physics Exploration)

In this session we will discuss how rate problems provide a foundation for geometry and fractions, and how the binomial expansion and the distributive rule ties mathematics together. We will take the binomial expansion into trigonometry, geometry, algebra, and calculus, thus showing the importance of complex numbers. We will augment this with a discussion of how the magic square develops productive habits for studying, learning, and thinking.

2:15-2:30 **Wrap Up**

RSVP to Mary Ann Huntley by 5 PM on Wed., Nov. 16th if you plan to attend.
E-mail: huntley@math.cornell.edu Phone: (607) 255-5529



Cornell University

K-12 Education and Outreach, Mathematics Department

MATH 5080

Mathematics for Secondary School Teachers

March 10, 2012

9:00 am – 2:30 pm

406 Malott Hall

8:45-9:00 **Welcome** (juice and bagels provided)

9:00-9:15 **Introductions**

9:15-11:00 **You are so mean! What *mean* do you mean?!**

Severin Drix (Ithaca High School) & Mircea Pitici (Cornell University)

The most common means (arithmetic, geometric, harmonic, quadratic) are many centuries old and ubiquitous in mathematics, from elementary uses to more advanced applications. Here we will look at the means from several perspectives; we define the means and explore their connections with geometry, music, algebraic inequalities, equations—and even mention some unsolved problems involving the means.

11:00-12:00 **Helping Students see the Beauty in Mathematics**

Lee Kaltman (DeWitt Middle School)

We all love math—that's why we teach it. Unfortunately, our students don't always feel the same way. Over the past seven years Lee has taught sixth-grade mathematics in two distinctly different school districts. He will share specific strategies he has used with students who have a predisposition to disliking math.

12:00-12:30 **Lunch** (provided)

12:30-2:15 **Mathematical Models: The Good, the Bad, and the Ugly**

Alexander Vladimirovsky (Cornell University)

Mathematical modeling provides a natural gateway into mathematics for students who might otherwise be uninterested in the subject. From a non-mathematician's point of view, models are useful only if they help to answer specific questions about the modeled ("real-world") systems. Thus, in designing models, it is crucial to be aware of their range of applicability and the modeling/simplification artifacts. In the second half of this session, Alex will present a gallery of models (e.g., severed nerves and motion of fingers; energy release in nuclear explosions; patterns in gas convection; flocking of birds; different methods of rounding and their effect on congressional elections; cell divisions and soap bubbles; pedestrian traffic and stability of bridges).

RSVP to Mary Ann Huntley by Wednesday, March 7th if you plan to attend.

E-mail: huntley@math.cornell.edu

Phone: (607) 255-5529



Cornell University
K-12 Education and Outreach, Mathematics Department

MATH 5080

Mathematics for Secondary School Teachers

April 21, 2012

9:00 am – 2:30 pm

406 Malott Hall

8:45-9:00 **Welcome** (juice and bagels provided)

9:00-9:15 **Introductions**

9:15-10:45 **Education of a Model Student**

Tim Novikoff (Cornell University)

While working as a PhD student in applied math at Cornell, former high-school math teacher Tim Novikoff created a popular flashcard-based iPhone app for studying vocabulary words. For the app he devised a simple algorithm to determine the exact sequence of flashcards shown to the user. Pondering the algorithm led him to ask novel questions about constructing mathematical sequences that satisfy certain constraints. Tim will present the accessible results of the mathematical investigation, including some puzzle-like mathematical questions that came out of it.

11:00-12:30 **Look in Your Experiences for the Meanings of Mathematics**

David Henderson (Cornell University)

David believes that the meaning of everything in mathematics comes from our human experiences; and, thus, we should look to our experiences to find meanings of mathematics. School textbooks and state standards still routinely provide definitions that block students' access to meanings; e.g., a popular high school geometry text defines "rotation" as "the product of two reflections over intersecting lines." In this talk, David will provide other examples and discuss how the experiences of mathematicians are needed to help school mathematics change its definitions and rules to bring out meanings, especially meanings that translate well to higher mathematics and various applications.

12:30-1:00 **Lunch** (provided)

1:00-2:30 **Surfing the Data Deluge**

Math Awareness Month Public Lecture—228 Malott Hall

Paul Velleman (Cornell University)

Drowning in data?! Come hear Paul Velleman, author of popular high-school textbooks and software packages for statistics, talk about how to stay on top of the data deluge.

RSVP to Mary Ann Huntley by 2 pm Friday, April 13th if you plan to attend.

E-mail: huntley@math.cornell.edu Phone: (607) 255-5529

B. Other Professional Development Activities

i. The Algebra Project

David Henderson (Math Department) continued his work writing special experiential-based high-school curriculum materials and working with teachers across the country as part of The Algebra Project, which serves students who are performing in the bottom quartile on state and national tests. His geometry curricular materials have been used in NY, CA, OH, MI, IL, MD, SC, FL, VA, and MS. For more detail about Henderson's work with the Algebra Project and its curriculum materials, see <http://www.math.cornell.edu/~henderson/AP/index.html>.

ii. Cornell University - Ithaca City School District Networking and Resource Fair

Mary Ann Huntley (Math Department) served on the planning committee, and participated in the inaugural Cornell University - Ithaca City School District Networking and Resource Fair. The fair was held at Ithaca High School on October 7, 2011. The purpose of the fair was to increase teachers' awareness of and promote effective utilization of outreach personnel and resources at Cornell. All Ithaca City School District teachers were required to attend. An article about the fair is online (<http://www.news.cornell.edu/stories/Oct11/ResourceFair.html>).

iii. Ithaca City District-Wide Math Committee

Mary Ann Huntley (Math Department) served on the Ithaca City District-Wide Math Committee. This working group reviewed critical data to better understand overall mathematics student achievement in grades PreK-12 and to consider recommendations to positively impact mathematics achievement in the district. The work accomplished by this group was shared with the Board of Education's subcommittee for Curriculum and Instruction.

iv. Advising Students

Mary Ann Huntley (Math Department) discussed career options and advised several undergraduate and graduate students who are interested in pursuing careers teaching mathematics.

2. Outreach to the Local Community

Faculty, graduate students, and undergraduate students participated in a wide range of activities serving the local community. Each is described in more detail on the following pages.

A. Mathematics Tutoring

As outlined in Table 2, Mary Ann Huntley (Math Department) organized tutoring at six local schools and one prison.² Tutoring was offered in a variety of formats (e.g., in-class tutoring, after-school tutoring, and one-on-one).

Table 2. Tutoring Sites and Structure

Site	Structure
Belle Sherman Elementary School	<ul style="list-style-type: none">• In-class tutoring• After-school SIFE Program (a program, run by Cornell's Cooperative Extension, for <u>S</u>tudents with <u>I</u>nterrupted <u>F</u>ormal <u>E</u>ducations)
Ithaca High School	<ul style="list-style-type: none">• In-class tutoring• Math Labs (an extra period of mathematics for those students who did not perform well on the prior year's standardized test)
MacCormick Secure Facility	<ul style="list-style-type: none">• In-class tutoring
Newfield Central Schools (Middle & High Schools)	<ul style="list-style-type: none">• After-school tutoring
New Roots Charter School	<ul style="list-style-type: none">• 1-1 or 1-2 tutoring
South Hill Elementary School	<ul style="list-style-type: none">• 1-1 tutoring for a student performing above grade level

Tutors benefited in two ways from our working relationship with Cornell's Public Service Center (PSC). First, to overcome the challenge of transportation to sites that are not accessible by walking or by using TCAT, people who tutored at the MacCormick Secure Facility borrowed a PSC van for transportation to and from that site.³ Second, one undergraduate took advantage of PSC's America Counts Program, in which federal work study students who work with students (two-thirds of whom are in 9th grade or below) can tutor for their work-study assignment.

As outlined in Table 3, the tutors included 18 people: one faculty member, six graduate students, and 11 undergraduates. They spent approximately 135 hours tutoring local students. An ongoing challenge is the small number of students who show up to receive tutoring. To address this problem, we request increased communication with the teachers and administrators who serve as on-site coordinators.

² In recent past, none of these sites had previously participated in our mathematics tutoring program.

³ Drivers must have had their license for at least three years and go through a short training.

Table 3. Mathematics Tutors

Name	Status	Field	Semester	Tutoring Site	Hours
Xiaodong Cao	Faculty	Math	Spring 2012	Belle Sherman (in class)	3
Chi-Kwong (Alex) Fok	Graduate Student	Math	Spring 2012	Newfield	4
Sarah Iams	Graduate Student	CAM	Spring 2012	Belle Sherman (in class)	5.5
Kyle Wilson	Graduate Student	CAM	Spring 2012	South Hill	12
Ka Yue (Daniel) Wong	Graduate Student	Math	Spring 2012	MacCormick	9
Chenxi Wu	Graduate Student	Math	Spring 2012	Ithaca High (Math Lab)	1.5
Steven Zimmerman	Graduate Student	Atmospheric Sciences	Spring 2012	MacCormick	9
Ye An	UG Junior	Math	Fall 2011	Ithaca High (Math Lab)	2.25
Brittany Dombrowski	UG Junior	Math, Economics	Spring 2012	Ithaca High (Math Lab)	32
Melissa Fiore	UG Junior	Math, Economics	Spring 2012	Ithaca High (Math Lab)	7.5
Brandon Hartstein	UG Senior	Math	Spring 2012	MacCormick	6
Katherine McCulloh	UG Senior	Math	Fall 2011, Spring 2012	Belle Sherman (SIFE Program)	22.5
Benjamin Nachman	UG Senior	Math, Physics, Economics	Fall 2011	Belle Sherman (SIFE Program)	6
Andrew Peterson	UG Junior	Economics	Spring 2012	Belle Sherman (in class)	5.5
Eric Primozic	UG Sophomore	Math	Spring 2012	New Roots	5
Steven Santos	UG Senior	Math, Physics	Spring 2012	New Roots	6
Andrew Simon	UG Junior	Math, Economics	Spring 2012	Ithaca High (Math Lab)	6.75
Keyi Wu	UG Freshman	Math	Spring 2012	Ithaca High (in class)	0.75

Surveys are administered to tutors at the beginning and end of each semester. Before tutoring begins, tutors are asked what they hoped to gain by participating in the tutoring program. Responses included wanting to help others, learning more about and giving back to the community surrounding Cornell, and obtaining teaching experience. At the end of the semester they are asked about the ways in which they benefited from participating in the tutoring. Responses included getting a sense of fulfillment while having fun helping others learn mathematics, learning how to explain elementary concepts to younger children, and having an opportunity to revisit content they had not seen in many years.

B. Ithaca High School Senior Seminar

The Senior Seminar is a class on advanced mathematics designed for students who have taken most of the mathematics classes available at Ithaca High School. It meets at the high school for one period during school hours three days a week. The purpose of the Senior Seminar is to introduce students to topics that they would typically not see until college, and to increase the number of high school students who major in mathematics in college. This year's Senior Seminar was funded by the Mathematics Department, the Center for Applied Mathematics, and the NSF-funded outreach grant (EMSW21-MCTP: High-School Outreach Programs, NSF Award #0602193). Dan Barbasch (Math Department) organized the seminar and observed occasionally.

There are two major activities of the Senior Seminar. The first part consists of three graduate students each teaching an eight week mini course. Descriptions of the mini courses offered by the graduate students in 2011-2012 are outlined in Table 4.

Table 4. Senior Seminar Topics, Instructors, and Course Descriptions

<p>Seminar 1 (9/20/11 – 11/10/11): Special Curves Instructor: Mircea Pitici (Graduate Student, Education)</p> <p><i>We explored various special curves, with an emphasis on geometric elements; occasionally we also studied the algebraic and trigonometric properties, and pointed out the importance of the curves in applications, for instance in the theory and construction of mechanisms. All along we considered other curves related to a given curve, such as pedal curves and envelopes. We started off with a unified view of conics offered by projective geometry, mentioning several major closure theorems (due to Pascal, Brianchon, Poncelet) and a potpourri of side results. We continued by examining in detail the cycloid, a few particular epicycloids and hypocycloids (cardioid, astroid, deltoid, nephroid), and various spirals. Pressed by time, we mentioned cursorily some of the properties of limaçon, lemniscates, and ovals.</i></p>
<p>Seminar 2 (11/15/11 – 1/19/12): Axiomatic Development of Probability Instructor: Mark Cerenzia (Graduate Student, Mathematics)</p> <p><i>This seminar presented the axiomatic approach to probability theory so that students could learn how mathematical machinery is built and applied. We began with a brisk introduction to relevant set theory in order to state the three axioms of probability (i.e., the definition of a measure space). We then derived typical properties one would expect when computing probabilities and showed how the framework helps us avoid pitfalls that both laymen and professionals often make. This led naturally into other core concepts, such as independence, conditional probability, Bayes' Formula, and random variables along with their important quantities (variance and expectation). Deriving everything formally from the axioms was the main feature and focus of this development.</i></p>
<p>Seminar 3 (1/31/12 – 3/27/12): Calculus of Variations Instructor: Anoop Grewal (Graduate Student, TAM)</p> <p><i>We started off with the historical beginning of the subject with the famous Brachistochrone problem by Johann Bernoulli. The general solution by Euler and Lagrange was derived and discussed next. We discussed many famous applications of calculus of variations in engineering and physics, including geodesics on the plane, cylinder and sphere; Lagrangian formulation of mechanics; and the catenary curve as minimum potential energy solution.</i></p>

The second major activity of the Senior Seminar consists of the high-school students doing projects under the direction and with the mentoring of the graduate students. The projects are proposed and supervised by the Senior Seminar instructors. While by no means new research, the projects enable students to explore topics of interest.

The Senior Seminar culminates in oral presentations of the project results. In past years these presentations were held at Ithaca High School. To increase interactions between the high-school students and members of the Cornell Math Department, this year the presentations were held at Cornell on Saturday, May 19. Altogether 22 people attended the event. Two photos and the agenda from the event are shown below.



**Ithaca High School
Senior Seminar
Participants**

1st Row
Emmett Kotlikoff, Max Yavitt,
Daniel Lee

2nd Row
Kengo Onishi, Austin
Nielsen, Anwar Omar, Lucas
Hahn, Severin Drix (teacher)

3rd Row
Mark Cerenzia, Mircea Pitici,
Anoop Grewal (graduate
student mentors)



**Ithaca High School
students Max Yavitt &
Kengo Onishi explain
catenoid soap surfaces**

<http://chronicle.cornell.edu/>

*Jason Koski/University
Photography*



Cornell University

K-12 Education and Outreach, Mathematics Department

2012 Ithaca High School Senior Seminar Student Research Presentations

Saturday, May 19, 2012

10:00 am – 2:30 pm

406 Malott Hall

- 10:00-10:05 Welcome**
Severin Drix (Ithaca High School)
Mary Ann Huntley (Cornell University)
- 10:10-10:40 Central Limit Theorem**
Daniel Lee (Ithaca High School)
Mark Cerenzia (Cornell University)
- 10:45-11:35 Catenoid Soap Surfaces**
Kengo Onishi & Max Yavitt (Ithaca High School)
Anoop Grewal (Cornell University)
- 11:45-12:15 Lunch (provided)**
- 12:25-1:15 Arbelos**
Austin Nielsen & Emmett Kotlikoff (Ithaca High School)
Mircea Pitici (Cornell University)
- 1:20-2:10 Minimum Distance on the Temperature-Distorted Disk**
Anwar Omar & Lucas Hahn (Ithaca High School)
Anoop Grewal (Cornell University)
- 2:15-2:30 Final Remarks**
Severin Drix (Ithaca High School)
Edward Swartz, Mircea Pitici, & Anoop Grewal (Cornell University)

RSVP to Mary Ann Huntley by 4 pm Tuesday, May 15th if you plan to attend.

E-mail: huntley@math.cornell.edu Phone: (607) 255-5529

C. Mathematics Awareness Month

This year's theme for Math Awareness Month was "Mathematics, Statistics, and the Data Deluge." Consistent with this theme, Paul Velleman (Associate Professor, Department of Social Statistics, School of Industrial and Labor Relations) gave a public lecture on April 21, 2012 entitled, *Surfing the Data Deluge*. Approximately 35 people attended the lecture, which was planned to coincide with the final workshop of the semester for local mathematics teachers (MATH 5080). The public lecture was videotaped. The flyer for the event and an article that was published in the Cornell Chronicle are shown below.



Public Lecture
Mathematics Awareness Month

Saturday, April 21, 2012

Paul Velleman, Cornell University
Surfing the Data Deluge

Are you worried that you might drown in the data deluge? A few insights can help you stay afloat. You need to understand:

- *How to look at data,*
- *Why randomness is better than certainty,*
- *How to protect yourself from the most dangerous equation in history,*
- *Why statistics is about ethics,*
- *That surfing the data deluge can be fun,*
- *That this year's "Math Awareness Month" theme isn't about math.*

Mathematics, Statistics, and the Data Deluge
Math Awareness Month
April 2012 - www.mathaware.org

1:00 PM - Bache Auditorium - 228 Malott Hall
Join us outside the auditorium at 2:15 PM for refreshments after the talk.

CHRONICLE ONLINE

April 25, 2012

Statistics professor helps navigate the 'data deluge'

By Farhan Nuruzzaman

Humanity is generating massive amounts of data, and extracting useful information from this deluge is extremely challenging, said Paul Velleman, associate professor of social statistics, at a public lecture April 21 in celebration of National Math Awareness Month.

In his lecture, "Surfing the Data Deluge," Velleman noted that in 2005, approximately 1 billion gigabytes of data were generated. Just five years later, it was eight times that amount. This massive mushrooming of information will soon overwhelm our ability to store the data, Velleman said.



Jason Koski/University Photography

Statistician Paul Velleman explains the methods researchers use to sift through the enormous amounts of data being generated.

One way to make sense of all this data is through data mining, which uses statistical methods and computer algorithms to discover patterns. However, Velleman pointed out that without meaningful questions to guide it, data mining isn't very helpful.

A better alternative would be to "surf the deluge" and to learn to think statistically, which humans don't do naturally, he continued. Thinking statistically is often counterintuitive, he said, and can require effort.

One case where statistics can be confusing is in presidential election polls, Velleman said, as different polls give different results for predicted winners. While Gallup predicts that Mitt Romney will win the election, NBC and the Wall Street Journal predict Barack Obama.

Why do these polls give conflicting results? Individuals, samples, statistical methods and polling organizations all vary, and these can account for the discrepancies often observed in poll results, Velleman said.

To effectively examine polls, one should look at who was sampled, the size of the sample and how the question was worded, he said. For instance, respondents are more likely to reply affirmatively to a question asking whether they favor "President Obama" over whether they favor "Obama," he said.

Another area where statistical thinking can be revealing is in selecting lottery numbers, for which people often develop strategies. For instance, Velleman noted that people often use "hot" numbers -- numbers that have come up recently, or "lucky" numbers.

Velleman pointed out the futility of this approach, because the set of lottery numbers isn't just random, but is an independent event.

"There's no way pingpong balls can remember what was selected in any previous time, and either be 'hot' or be 'due' or be more random or less random," he said. "Every possible collection of five eligible numbers is equally likely."

Statistical thinking isn't about mathematical ability, Velleman concluded, but it does require thinking in ways that often don't come naturally to people. He noted that Mark Twain said he was "beguiled" by figures, leading to his oft-quoted "There are three kinds of lies: lies, damned lies and statistics." Velleman said he believes Twain was referring to an alternate definition of "beguile": "to win and hold somebody's attention, interest or devotion."

"I like to think that Twain was beguiled by arranging his figures because he discovered the truth in his data," Velleman said. "I hope that you, too, will be beguiled by statistics."

Farhan Nuruzzaman '12 is a writer intern for the Cornell Chronicle.

Also to celebrate Mathematics Awareness Month, the Mathematics Department partnered with Ithaca High School on its annual t-shirt design contest. Thirty-five high-school students submitted designs and faculty at the high school voted for their favorites. The five designs receiving the most votes were brought to Cornell (<https://plus.google.com/photos/109954598780598648262/albums/5725324604201992497?banner=pwa>), where faculty, students, and staff voted for their favorite. The winning design, shown below, was developed by Ithaca High School student Sofia Escobedo-Tejado.



D. EMSW21-MCTP: High School Outreach Programs (NSF Award #0602193)

PI: Mary Ann Huntley (Math Department)

Co-PIs: Dan Barbasch, Kenneth Brown, Edward Swartz, Maria Terrell (Math Department)

This NSF-funded project is part of the Enhancing the Mathematical Sciences Workforce in the 21st Century (EMSW21) program, which has as its goal to increase the number of well-prepared U.S. citizens, nationals, and permanent residents who pursue careers in the mathematical sciences and in other NSF-supported disciplines. Within the EMSW21 program, this grant is part of the Mentoring through Critical Transition Points (MCTP) program. This was the final year of the grant. Major activities during the past year include the following.

1. Ithaca High School Senior Seminar (see pp. 11-13)
2. Revision & Dissemination of Math Explorer's Club Activities

The Math Explorer's Club (MEC) activities are an online repository of independent self-contained modules that are geared toward advanced middle- and high-school students. Based on feedback from teachers, three types of changes were deemed necessary in order to increase use of the activities in classroom and after-school settings. First, introductory material needs to be written to introduce the core content of the activities and to lighten the reading load. Second, the online material must be made into worksheets that teachers can print and distribute to students. Third, the activities must be correlated with the Common Core State Standards – Mathematics (CCSS-M).

To accomplish this, Jasdeep Singh Hundal (undergraduate computer science major) organized a team of undergraduates (Benjamin Greenman, Anthony Hawkins, Xing Lu, Robert Ravier, Yipu Wang, and Wendy Zeng) to do the rewriting. They chose to revise four of the activities: KenKen Puzzles, Fast Computations, Mathematics of Distance, and Error Correcting Codes.

Mary Ann Huntley (Math Department) recruited three teachers to test the revised materials: Francesca Crannell (Lansing Middle School), Benjamin Kirk (Ithaca High School), and Christine Klee (Cohen Middle School, Elmira). Feedback has been obtained, and the activities are being further revised by the undergraduates during Summer 2012. The revised modules will be posted online.

A book, entitled *Adventures in Everyday Mathematics*, is based on topics from the MEC activities. This book is being published by Princeton University Press. The editor of the book is Benjamin Lundell (Ph.D., 2011), and chapters are authored by former doctoral students Jason Anema (Ph.D., 2012), Jennifer Biermann (Ph.D., 2011), Saul Blanco-Rodriguez (Ph.D., 2011), Christopher Cunningham (Ph.D., 2011), Peter Luthy (Ph.D., 2012), Russ Thompson (Ph.D., 2011), and Gwyneth Whieldon (Ph.D., 2011).

E. Johns Hopkins University's Center for Talented Youth

On October 22, 2011, Cornell University's Department of Mathematics and Center for Applied Mathematics (CAM) hosted a Johns Hopkins University Center for Talented Youth (JHU CTY) Family Academic Program. The target audience was grades 7-10 students, and every student was required to be accompanied by at least one parent/guardian. In all, 100 people attended the event – 53 students and 47 parents/guardians. They came from seven states in the Northeast and Mid-Atlantic regions of the United States: NJ (38), NY (31), MD (8), VA (7), MA (6), CT (6), and PA (4). The cost for attending was \$95 per person, plus associated travel expenses.

Keynote talks were given by Math Department faculty members Ravi Ramakrishna (*What is Calculus?*) and Timothy Healey (*The Bernoullis, Euler, and the Beginnings of Calculus in Structural Mechanics*). Graduate students offered three break-out sessions.⁴

- *Networks All Around* – Kathryn Sullivan (organizer), Diarmuid Cahalane, Isabel Kloumann, Dana Warmesley (CAM)
- *Chaos!* – Matthew Holden (organizer), Sumedh Joshi, Elizabeth Wesson, Kyle Wilson (CAM)
- *Tilings* – Anna Bertiger (organizer), Adam Bjorndahl, Robert Kesler, Laura Escobar Vega (Math)

Every student and every parent/guardian attended each break-out session, with roughly 15-20 participants attending each session. Parallel sessions were offered for students and parents/guardians—as each student cycled through the break-out sessions, their parent/guardian attended the same sessions but in a different room.

As part of its ongoing program evaluation, JHU CTY administered a general survey to all participants. Altogether, 81 surveys were returned, 40 from students (77% response rate) and 41 from parents/guardians (87% response rate). An indication of the program's success is captured by participants' responses to Question 4 on this survey, which asked, "Would you recommend this program to another CTY family?" The responses to this question were overwhelmingly positive, with 97.5% of students and 90% of parents/guardians saying they would recommend this program to another family.

In order to obtain detailed feedback from participants about their experiences throughout the day, the graduate student organizers administered surveys to students, parents/guardians, and presenters. A detailed report on findings is available upon request.

⁴ These topics are the same as those presented at prior JHU CTY events. This was a deliberate decision, as this year Mary Ann Huntley focused on mentoring the graduate students in program evaluation, rather than having the graduate students develop new activities.

F. Cornell Math Puzzle Nights

Anastasia Raymer (Visiting Assistant Professor of Mathematics) organized monthly puzzle sessions on the first Thursday of every month during the Spring 2012 semester. During these sessions, Anastasia, together with volunteers from Cornell's Math Club, provided middle- and high-school students with a fun, enthusiastic, non-competitive environment in which to explore mathematics and to practice creative problem solving. A wide variety of puzzles were available, including some intended to expose students to new mathematical ideas. During these sessions, students were encouraged to interact with each other, as well as with the undergraduates, in brainstorming and coming up with solutions. Anastasia developed a website for this outreach activity (<http://www.math.cornell.edu/~araymer/Puzzle/PuzzleNights.html>). Students who attended the sessions ranged from grades 6-12. Between 2-8 students attended each session. Surveys were administered to students at the conclusion of some of the puzzle sessions. Students reported that they found the puzzles interesting and that they learned some new mathematical content.

Some flyers advertising the puzzle nights are shown below. Articles about the Math Puzzle Nights were published in the Ithaca Journal and Cornell Chronicle.

Mathematical Puzzle Night
With the Cornell Math Club!

What do little elves skipping up stairs have to do with this spiral and those bunnies? Come unleash the creative side of your brain solving fun math and logic puzzles with your friends and you just might find out!

Thursday, March 1st 6:30pm
Malott Hall at Cornell University
Visit the Community Outreach page at www.math.cornell.edu

The flyer features a large Fibonacci spiral on the left, with rabbits in the background. On the right, there are four colored squares (green, blue, yellow, purple) with labels $1/\varphi$, $1/\varphi^2$, $1/\varphi^3$, and $1/\varphi^4$ respectively. A bracket labeled '1' spans the width of the spiral area.

Join Cornell Math Club members for

Mathematical

PUZZLE PUZZLE PUZZLE PUZZLE PUZZLE PUZZLE PUZZLE PUZZLE

Sessions

Thursday, April 5th at 6:30pm
532 Malott Hall (Cornell)
Visit the Community Outreach page at www.math.cornell.edu for details.

The flyer has a green chalkboard background. The word 'Mathematical' is written in cursive. Below it, the word 'PUZZLE' is repeated multiple times in a grid. To the right, there is a small diagram of a cube. Below that, the word 'Sessions' is written in cursive, followed by a small tree diagram. A white box contains the event details.

Join Cornell Math Club Members For

Mathematical Puzzle Night

Games

Thursday, May 3rd
6:30pm-8pm
532 Malott Hall (Cornell)
Visit the Community Outreach page at www.math.cornell.edu for details.

The flyer has a white background. It features three knot diagrams: a trefoil knot, a square knot, and a more complex knot. The text is arranged in a clean, modern layout.

CHRONICLE ONLINE

Feb. 13, 2012

Math Club hosts high schoolers for monthly puzzle night

By Linda B. Glaser

Cornell's Math Club knows how to have a good time. Twice a month, the club gathers for pizza and math puzzles, cookies and camaraderie, in the fifth-floor lounge in Malott Hall. On Feb. 2, area high school students joined club members for an evening of recreational puzzles that featured rambunctious elves, mice-gobbling cats and broken toasters. The club now plans to make this a monthly outreach event.

"We wanted to give high school students a way to engage with math in a warm and welcoming atmosphere," said Tasia Raymer, visiting assistant professor of math, who suggested inviting local students.

Lansing student Shiloh Worthington said she'd been having some trouble with math and thought Puzzle Night could be useful. "It was really fun," Worthington said. "These kinds of problems are more creative than what we usually do in school. If math were more like this, I'd like it better."

Former club president

Richard Gustavson '11, a mathematics graduate student at the City University of New York, recalled that the first Puzzle Night he presided over drew a big, enthusiastic crowd, which didn't surprise him. "It's a fun exercise, and it's great for the mind," said Gustavson. "When you're doing puzzles, you're really doing what mathematicians do. It's a whole different way of thinking."

Timothy Riley, assistant professor math and club adviser, said that the puzzles also help develop critical thinking beyond math. "Puzzles stretch the imagination. They often have ingenious or quirky solutions so you have to think in original ways, and they can be doorways to grander ideas." He pointed out that puzzles have even inspired new areas of research, such as the famous Seven Bridges of Königsberg problem; its solution laid the foundations of graph theory and anticipated the field of topology.

All are welcome to Puzzle Nights, which occur every other week during the semester. "This is a social gathering as well as an intellectual exercise," said club president Nathan Jacobson '13. "People are encouraged to talk amongst themselves and discuss what they think the solution would be."

Jacobson double majors in math and philosophy because of his deep interest in logic, which he said forms the foundation of both math and philosophy. "Many people view math as computation and nothing more, but I feel that what's really crucial are the interesting proofs and truths you can discover through mathematics," he said. "The Math Club allows people to come and see that side of math."

Jacobson was quick to point out that there's nothing wrong with computation; it's what drives science and engineering. "But some people think if they're bad at computation they must be bad at math, when really there's this whole other layer to mathematics that they might be perfectly good at, and they'll never know if they don't try it."

Other Math Club activities include faculty talks, career info sessions, social events and guest lecturers. Last year's highlights featured student presentations on mathematical typesetting as well as a talk by associate professor Tara Holm, who used square dancing to introduce key ideas in topology.

"We like to integrate undergrads, grads and faculty for activities, and the Math Club is a place where this happens," said Riley.

Linda B. Glaser is staff writer for the College of Arts and Sciences.

Typical problems presented at Puzzle Night

Puzzle 1: In making breakfast, Julie wants one piece of toast and her little brother wants two. Their toaster fits two pieces of bread at a time but only toasts one side of each slice. They want both sides toasted so Julie has to remove each slice, turn it over and toast again. It takes one minute for the toaster to toast one side of each slice of bread in the toaster. It took Julie four minutes to toast all three slices. When she put the toast on the table her brother complained, "Why did you do it the *slow* way when you know I'm hungry?" Julie wonders if it is possible to toast both sides of three slices of bread in less than four minutes? Is it? If so, how?

Puzzle 2: Tim's grandma makes him an apple pie. He knows that with one straight cut he can divide the pie into two pieces, and that if he make a second straight cut he can divide the pie into four pieces. Tim looks at the pie after making two straight cuts and observes that he can produce at most seven pieces of pie with a third straight cut. What is the largest number of pieces of pie Tim will have after making six straight cuts?

Solutions are available at <http://www.math.cornell.edu/~araymer/Puzzle/PuzzleNights.html>.



Robert Barker/University Photography
Visiting professor Tasia Raymer explains a math puzzle to one of the local high school students during the Math Club Puzzle Night in Malott Hall.



Robert Barker/University Photography
Math Club Puzzle Night at Malott Hall

G. 4-H Career Explorations Program

For 90 years, Cornell Cooperative Extension's 4-H Youth Development program has conducted an annual event for youth on the Cornell University campus. The purpose of this program, now called 4-H Career Explorations, is to provide students with exposure to academic fields and career exploration, to develop leadership skills, to provide hands-on experience in a college setting, and to introduce youth to Cornell University. This three-day event has two grade-specific tracts: University U for youth entering grades 8-9 and Focus for Teens for youth entering grades 10-12.

This year Danielle Toupo (graduate student, CAM) and Kristen Pueschel (graduate student, mathematics), led the Math Department's contribution to the University U program in a session entitled "Hands-On Math." On June 27-28, 2012, they hosted six groups of approximately 15 students each. During each session they discussed careers in mathematics and participants did two activities. The first focused on optimization (the problem was a variation of the traveling salesman problem), and the second focused on the concepts of mean, median, and probability (participants played a game similar to the popular television show "Deal or No Deal").



4-H Career Explorations

Danielle Toupo (graduate student, CAM) & Kristen Pueschel (graduate student, mathematics)

H. Other Outreach to the Local Community

i. Presentation to Lansing High School Math Club

On March 2, 2012, Richard Rand (Math Department) gave a presentation to the Lansing High School Math Club entitled “The Ancient Egyptian Value of π : An ancient mystery solved.” It focused on the fact that the Ancient Egyptian value of π was $\frac{256}{81}$, not $\frac{22}{7}$, the value that we often use as an approximation nowadays. He explained the mystery as to how they got this value and shed some light on it by looking at an ancient Egyptian papyrus. The talk was designed to be understandable by any high-school student. Approximately 40-50 people attended the talk, including about four adults. The students gave Richard an apple pie, and he donated to the school library a copy of the book *A History of Pi*.

ii. Communicating Mathematics to the Public

Over the past year, Steven Strogatz (Math Department) spoke at Cornell, gave invited lectures, appeared on radio, had press coverage, and engaged in other outreach activities. These are listed below.

- Cornell Lectures and Service Events
 - 9/14/11 – Faculty Salon with Tanner Dean’s Scholars, College of Arts and Sciences
 - 9/21/11: “Doing Math in Public,” Bethe Ansatz, Bethe House
- Invited Lectures
 - 10/11/11 – “Sync,” Butler University, Woods Science Lecture Series
 - 2/3/12 – “Social Networks that Balance Themselves,” Math Dept., University of Rome “La Sapienza”
 - 2/28/12 – “Sync”, Physics Dept., University of Rome “La Sapienza”
 - 5/4/12 – “Social Networks that Balance Themselves,” Mathematics Dept., Oxford University
- Radio
 - 8/22/11 – Big Picture Science Radio Show, “Swarm in here – or is it just me?”
[Part 1: Steve Strogatz on Sync](#)
[Part 5: Chaos and Complexity](#)
 - 10/4/11 – RadioLab, “[Loops](#),” WNYC, National Public Radio
- Press Coverage
 - 8/12/11 – “Orchestrated chaos: market correlations skyrocket this week,” Market Watch
(<http://blogs.marketwatch.com/thetell/2011/08/12/orchestrated-chaos-market-correlations-skyrocket-this-week/>)
 - 9/30/11 – F. Manjoo, Slate Magazine, “Will robots steal your job?”
(http://www.slate.com/articles/technology/robot_invasion/2011/09/robot_invasion_can_computers_replace_scientists.html)
 - 11/11/11 – “RIDM 2011: A Simple Rhythm (but an intriguing one),” Montreal Gazette

intuitive problem. The pendulum was also a big success because the presenters were able to set up a "what will happen" question about chaotic systems and have the children posit a theory before using the pendulum to do the experiment to answer the question.

iv. Ithaca High School Math Team

Chenxi Wu (graduate student, Math Department) assisted Fred Deppe (math teacher) in coaching the Ithaca High School Math Team. Chenxi attended five practice sessions during the Spring 2012 semester. The team participated in the New York State Mathematics League (NYSML) competition, which was held April 28, 2012 at the Susquehanna Valley High School in Conklin, NY. The team took last place (out of 11 teams) in the Division A competition. The team suffered from having only six members. (A full team consists of 15 people.) The team lost many points on the individual round, but earned 44/50 points in the power round. According to Fred Deppe, "They did pretty good, all things considered."

This year the IHS Math Team endured major challenges. Students have competing demands on their time (e.g., the Math Team meetings are held the same time as the Code Red Robotics Team Meetings). Another challenge is the Ithaca Math Circle, another group of youth in the Ithaca area that prepares for math contests.

v. AMC Competition

On February 22, 2012 the Math Department offered the 10B and 12B American Mathematics Contests (AMC), sponsored by the Mathematical Association of America. Jason Anema (graduate student, mathematics) administered the exams. Eleven students from Ithaca High School and Cascadilla School sat for the exam. Three students took the 10B exam, and eight students took the 12B exam.

vi. Partner School – Tucson, AZ

During Fall 2011 Mary Ann Huntley (Math Department) was contacted by Suzi Hileman,⁵ a volunteer working with an 8th-grade math teacher in the Amphitheater School District in Tucson, AZ. Most of the students at the school are immigrants with little experience in higher education, yet the goal is to send each one to college. The math department at the school chose the Ivy League as their theme, and the 8th grade class chose to partner with Cornell University. We planned to provide mentoring and activities for the students. Lucien Clavier (graduate student, mathematics) and Jasdeep Hundal (undergraduate computer science major) provided written responses to questions that the eighth-graders posed, including choosing math/science as a field of study, college life, and their hometowns. We had planned to pilot the revised Math Explorer Club activities with this group of students, but this did not happen due to staffing changes at the school.

⁵ Suzi Hileman survived a gunshot wound in Tucson with Representative Gabrielle Giffords on January 8, 2011. Her mentoring program grew out of this experience with Representative Giffords. Suzi Hileman is a Cornell graduate (HuEd '73) and Gabrielle Giffords did her Fulbright work at Cornell University.

Appendix A: Summary of Mathematics Outreach Activities

Activity	Dates	Description
New York State Fair 4-H Building	9-2-11 & 9-5-11	Over-arching theme: Math can be applied to unexpected areas, especially to aid in understanding when simple intuition fails us. Activities included the following: chaotic double pendulum, Monty Hall game, "Lumber Rescue" (a computer game under development by Dave Schneider), and a coloring station for younger children. <i>Diarmuid Cahalane, Matt Holden, Sarah Iams, Isabel Kloumann, Rocio Ruelas, Maarika Teose (CAM Grad Students)</i> <i>Eoin O'Mahony, Vasu Raman (CS Grad Students)</i>
MATH 5080 Saturday Workshop for Math Teachers	10-1-11	Getting a Grip on the Common Core State Standards for Mathematics Mary Ann Huntley (Math Dept.), Eric Robinson (Ithaca College) The Mathematics of Magic Tricks <i>John Maceli (Ithaca College)</i> Fostering Collaborations between Local Mathematics Teachers and the Cornell Mathematics Department <i>Dan Barbasch, Mary Ann Huntley (Math Dept.)</i>
CU-ICSD Networking & Resource Fair Ithaca High School	10-7-11	Approx. 600 teachers in the Ithaca City School District attended the Resource and Networking Fair at Ithaca High School to learn about Cornell resources. <i>Mary Ann Huntley (Math Dept.)</i>
Johns Hopkins University Center for Talented Youth Family Academic Program	10-22-11	Keynote Talks What is Calculus? <i>Ravi Ramakrishna (Math Dept.)</i> The Bernoullis, Euler, and the Beginnings of Calculus in Structural Mechanics <i>Tim Healey (Math Dept.)</i> Break Out Sessions Networks All Around <i>Kathryn Sullivan, Diarmuid Cahalane, Isabel Kloumann, Dana Warmsley (CAM Grad Students)</i> Chaos! <i>Matt Holden, Sumedh Joshi, Elizabeth Wesson, Kyle Wilson (CAM Grad Students)</i> Tilings <i>Anna Bertiger, Adam Bjorndahl, Robert Kesler, Laura Escobar Vega (Math Grad Students)</i>
MATH 5080 Saturday Workshop for Math Teachers	11-19-11	Digital Natives & the NTCM Communication Standards <i>Chris Hartmann (Parametric Technology Corporation)</i> Reaching Recalcitrant High School Students <i>Irvin M. Miller & Robert L. Morrison (Math & Physics Exploration)</i>
School Tutoring	Fall 2011	Students with Interrupted Formal Education (SIFE), an after-school program of the Cooperative Extension of Tompkins County @ Belle Sherman Elementary School <i>Katie McCulloh, Ben Nachman (Undergrads)</i> Math Labs @ Ithaca High School <i>Ye An (Undergrad)</i>
Senior Seminar Ithaca High School	Fall 2011	Special Curves <i>Mircea Pitici (Education Grad Student)</i> Axiomatic Development of Probability <i>Mark Cerenzia (Math Grad Student)</i>
Ithaca City District-Wide Mathematics Committee	Fall 2011	Review critical data to better understand overall math student achievement PreK-12 & consider recommendations to positively impact math achievement in the district. <i>Mary Ann Huntley (Math Dept.)</i>

Partner School Tucson, AZ	Fall 2011	Provide mentoring and activities to students at Amphitheater School District in Tucson, AZ. <i>Lucien Clavier (Math Grad Student) & Jasdeep Hundal (Undergrad)</i>
Math Puzzle Night Cornell University	2-2-12	Middle- and high-school students explore mathematics & practice creative problem solving <i>Anastasia Raymer (Math Dept.) & Undergraduate Math Club</i>
AMC Competitions Cornell University	2-22-12	High-school students took the 10B & 12B AMC Exams <i>Jason Anema (Math Grad Student)</i>
Math Puzzle Night Cornell University	3-1-12	Middle- and high-school students explore mathematics & practice creative problem solving <i>Anastasia Raymer (Math Dept.) & Undergraduate Math Club</i>
Lansing High School Math Club	3-2-12	The Ancient Egyptian Value of π <i>Richard Rand (Math Dept.)</i>
MATH 5080 Saturday Workshop for Math Teachers	3-10-12	You are so Mean! What do you mean? <i>Severin Drix (Ithaca High School) & Mircea Pitici (Education Grad Student)</i> Helping Students see the Beauty in Mathematics <i>Lee Kaltman (DeWitt Middle School)</i> Mathematical Models: The Good, the Bad, and the Ugly <i>Alexander Vladimirsky (Math Dept.)</i>
Math Puzzle Night Cornell University	4-5-12	Middle- and high-school students explore mathematics & practice creative problem solving <i>Anastasia Raymer (Math Dept.) & Undergraduate Math Club</i>
MATH 5080 Saturday Workshop for Math Teachers	4-21-12	Education of a Model Student <i>Tim Novikoff (CAM Grad Student)</i> Look in Your Experiences for the Meanings of Mathematics <i>David Henderson (Math Faculty)</i> Surfing the Data Deluge <i>Paul Velleman (ILR Faculty)</i>
Math Awareness Month Public Lecture	4-21-12	Surfing the Data Deluge <i>Paul Velleman (ILR)</i>
Math Puzzle Night Cornell University	5-3-12	Middle- and high-school students explore mathematics & practice creative problem solving <i>Anastasia Raymer (Math Dept.) & Undergraduate Math Club</i>
Senior Seminar Ithaca High School	5-19-12	High-school student research presentations <i>Mark Cerenzia (Math Grad Student), Anoop Grewal (TAM Grad Student), Mircea Pitici (Education Grad Student)</i>
4-H Career Explorations Cornell University	6-26-12 6-27-12	University U Program <i>Danielle Toupo (CAM Grad Student), Kristen Pueschel (Math Grad Student)</i>
School Tutoring	Spring 2012	Belle Sherman Elementary School (Students with Interrupted Formal Education (SIFE), an after-school program of the Cooperative Extension of Tompkins County) <i>Katie McCulloh (Undergrad)</i> Belle Sherman Elementary School (in-class tutoring) <i>Xiaodong Cao (Math Dept.), Sarah Iams (CAM Grad Student), Andrew Peterson (Undergrad)</i> Ithaca High School (Math Lab tutoring) <i>Brittany Dombrowski (Undergrad), Melissa Fiore (Undergrad), Andrew Simon (Undergrad), Chenxi Wu (Math Grad Student)</i> Ithaca High School (in-class tutoring) <i>Keyi Wu (Undergrad)</i> MacCormick Correctional Facility (in-class tutoring) <i>Brandon Hartstein (Undergrad), Ka Yue (Daniel) Wong (Math Grad)</i>

		<p><i>Student), Steven Zimmerman (Atm. Sci. Grad Student)</i> New Roots Charter School (1-1 or 1-2 tutoring) <i>Eric Primozic (Undergrad), Steven Santos (Undergrad)</i> Newfield High School (after-school tutoring) <i>Chi-Kwong (Alex) Fok (Math Grad Student)</i> South Hill Elementary School (1-1 tutoring) <i>Kyle Wilson (CAM Grad Student)</i></p>
Senior Seminar Ithaca High School	Spring 2012	<p>Calculus of Variations <i>Anoop Grewal (TAM Grad Student)</i></p>
Math Team Ithaca High School	Spring 2012	<p>Participate in practice sessions in preparation for the NY State Mathematics League competition <i>Chenxi Wu (Math Grad Student)</i></p>
MEC Activities	Spring 2012	<p>Revise a subset of the online Math Explorers' Club activities. <i>Jasdeep Singh Hundal, Benjamin Greenman, Anthony Hawkins, Xing Lu, Robert Ravier, Yipu Wang, Wendy Zeng (Undergrads)</i> <i>Francesca Crannell, Benjamin Kirk, Christine Klee (Teachers)</i></p>

Appendix B: People who Offered Outreach Activities (sorted alphabetically)

Name	Position	Major/Department	Outreach Activity
Ye An	Undergraduate Junior	Math Major	Math Tutoring
Jason Anema	Graduate Student	Mathematics	AMC Competition
Dan Barbasch	Faculty	Mathematics	MATH 5080
Anna Bertiger	Graduate Student	Mathematics	JHU CTY
Adam Bjorndahl	Graduate Student	Mathematics	JHU CTY
Diarmuid Cahalane	Graduate Student	CAM	NYS Fair, JHU CTY
Xiaodong Cao	Faculty	Mathematics	Math Tutoring
Mark Cerenzia	Graduate Student	Mathematics	Senior Seminar
Lucien Clavier	Graduate Student	Mathematics	Partner School in Tucson, AZ
Francesca Crannell	Teacher	Lansing Middle School	Math Explorers Club Activities
Brittany Dombrowski	Undergraduate Junior	Math & Economics Major	Math Tutoring
Severin Drix	Math Teacher	Ithaca High School	MATH 5080
Melissa Fiore	Undergraduate Junior	Math & Economics Major	Math Tutoring
Chi-Kwong (Alex) Fok	Graduate Student	Mathematics	Math Tutoring
Benjamin Greenman	Undergraduate Junior	ILR	Math Explorers Club Activities
Anoop Grewal	Graduate Student	TAM	Senior Seminar
Chris Hartmann	Academic Program Manager	Parametric Technology Corp.	MATH 5080
Brandon Hartstein	Undergraduate Senior	Math Major	Math Tutoring
Anthony Hawkins	Undergraduate Sophomore	Physics Major	Math Explorers Club Activities
Timothy Healey	Faculty	Mathematics, Mechanical & Aerospace Engineering	JHU CTY
David Henderson	Faculty	Mathematics	MATH 5080, The Algebra Project
Matthew Holden	Graduate Student	CAM	NYS Fair, JHU CTY
Jasdeep Singh Hundal	Undergraduate Senior	Computer Science Major	Math Explorers Club Activities, Partner School in Tucson, AZ
Mary Ann Huntley	Faculty	Mathematics	MATH 5080, CU-ICSD Fair, Ithaca District Math Committee, Advising Students
Sarah Iams	Graduate Student	CAM	NYS Fair, Math Tutoring
Sumedh Joshi	Graduate Student	CAM	JHU CTY
Lee Kaltman	Math Teacher	DeWitt Middle School	MATH 5080
Robert Kesler	Graduate Student	Mathematics	JHU CTY
Benjamin Kirk	Teacher	Ithaca High School	Math Explorers Club Activities
Christine Klee	Teacher	Cohen M.S. (Elmira Hts)	Math Explorers Club Activities
Isabel Kloumann	Graduate Student	CAM	NYS Fair, JHU CTY
Xing Lu	Undergraduate Junior	Math & Economics Major	Math Explorers Club Activities
John Maceli	Faculty	Ithaca College Math Dept.	MATH 5080
Katherine McCulloh	Undergraduate Senior	Math Major	Math Tutoring
Irvin Miller	Volunteer (retired from IBM)	Math & Physics Exploration	MATH 5080
Robert Morrison	Volunteer (retired from IBM)	Math & Physics Exploration	MATH 5080
Benjamin Nachman	Undergraduate Senior	Math, Physics, & Economics Major	Math Tutoring

Timothy Novikoff	Graduate Student	CAM	MATH 5080
Eoin O'Mahony	Graduate Student	Computer Science	NYS Fair
Andrew Peterson	Undergraduate Junior	Economics Major	Math Tutoring
Mircea Pitici	Graduate Student	Education	MATH 5080, Senior Seminar
Eric Primozic	Undergraduate Sophomore	Math Major	Math Tutoring
Kristen Pueschel	Graduate Student	Mathematics	4-H Career Explorations
Ravi Ramakrishna	Faculty	Mathematics	JHU CTY
Vasu Raman	Graduate Student	Computer Science	NYS Fair
Richard Rand	Faculty	Mathematics, Mechanical & Aerospace Engineering	Lansing HS Math Club
Robert Ravier	Undergraduate Junior	Math Major	Math Explorers Club Activities
Anastasia Raymer	Faculty	Mathematics	Puzzle Nights
Eric Robinson	Faculty	Ithaca College Math Dept.	MATH 5080
Rocio Ruelas	Graduate Student	Computer Science	NYS Fair
Steven Santos	Undergraduate Senior	Math & Physics Major	Math Tutoring
Andrew Simon	Undergraduate Junior	Math & Economics Major	Math Tutoring
Steven Strogatz	Faculty	Mathematics, Mechanical & Aerospace Engineering	Communicating Mathematics to the Public
Kathryn Sullivan	Graduate Student	CAM	JHU CTY
Maarika Teose	Graduate Student	CAM	NYS Fair
Danielle Toupo	Graduate Student	CAM	4-H Career Explorations
Laura Escobar Vega	Graduate Student	Mathematics	JHU CTY
Paul Velleman	Faculty	ILR	MATH 5080, Math Awareness Month
Alexander Vladimirsky	Faculty	Mathematics	MATH 5080
Yipu Wang	Undergraduate Junior	Math & Computer Science Major	Math Explorers Club Activities
Dana Warmesley	Graduate Student	CAM	JHU CTY
Elizabeth Wesson	Graduate Student	CAM	JHU CTY
Kyle Wilson	Graduate Student	CAM	JHU CTY, Math Tutoring
Ka Yue (Daniel) Wong	Graduate Student	Math	Math Tutoring
Chenxi Wu	Graduate Student	Math	Math Tutoring, IHS Math Team
Keyi Wu	Undergraduate Freshman	Math Major	Math Tutoring
Wendy Zeng	Undergraduate Sophomore	Math & Economics Major	Math Explorers Club Activities
Steven Zimmerman	Graduate Student	Atmospheric Sciences	Math Tutoring

Appendix C: People who Offered Outreach Activities (sorted by activity)

Name	Outreach Activity	Position	Major/Department
Dan Barbasch	MATH 5080	Faculty	Mathematics
Severin Drix	MATH 5080	Math Teacher	Ithaca High School
Chris Hartmann	MATH 5080	Academic Program Manager	Parametric Technology Corp.
David Henderson	MATH 5080	Faculty	Mathematics
Mary Ann Huntley	MATH 5080	Faculty	Mathematics
Lee Kaltman	MATH 5080	Math Teacher	DeWitt Middle School
John Maceli	MATH 5080	Faculty	Ithaca College Math Dept.
Irvin Miller	MATH 5080	Volunteer (retired from IBM)	Math & Physics Exploration
Robert Morrison	MATH 5080	Volunteer (retired from IBM)	Math & Physics Exploration
Timothy Novikoff	MATH 5080	Graduate Student	CAM
Mircea Pitici	MATH 5080	Graduate Student	Education
Eric Robinson	MATH 5080	Faculty	Ithaca College Math Dept.
Paul Velleman	MATH 5080,	Faculty	ILR
Alexander Vladimirsky	MATH 5080	Faculty	Mathematics
David Henderson	The Algebra Project	Faculty	Mathematics
Mary Ann Huntley	CU-ICSD Fair	Faculty	Mathematics
Mary Ann Huntley	Ithaca District Math Committee	Faculty	Mathematics
Mary Ann Huntley	Advising Students	Faculty	Mathematics
Ye An	Math Tutoring	Undergraduate Junior	Math Major
Xiaodong Cao	Math Tutoring	Faculty	Mathematics
Brittany Dombrowski	Math Tutoring	Undergraduate Junior	Math & Economics Major
Melissa Fiore	Math Tutoring	Undergraduate Junior	Math & Economics Major
Chi-Kwong (Alex) Fok	Math Tutoring	Graduate Student	Mathematics
Brandon Hartstein	Math Tutoring	Undergraduate Senior	Math Major
Sarah Iams	Math Tutoring	Graduate Student	CAM
Katherine McCulloh	Math Tutoring	Undergraduate Senior	Math Major
Benjamin Nachman	Math Tutoring	Undergraduate Senior	Math, Physics, & Economics Major
Andrew Peterson	Math Tutoring	Undergraduate Junior	Economics Major
Eric Primozic	Math Tutoring	Undergraduate Sophomore	Math Major
Steven Santos	Math Tutoring	Undergraduate Senior	Math & Physics Major
Andrew Simon	Math Tutoring	Undergraduate Junior	Math & Economics Major
Kyle Wilson	Math Tutoring	Graduate Student	CAM
Ka Yue (Daniel) Wong	Math Tutoring	Graduate Student	Math
Chenxi Wu	Math Tutoring	Graduate Student	Math
Keyi Wu	Math Tutoring	Undergraduate Freshman	Math Major
Steven Zimmerman	Math Tutoring	Graduate Student	Atmospheric Sciences
Mark Cerenzia	Senior Seminar	Graduate Student	Mathematics
Anoop Grewal	Senior Seminar	Graduate Student	TAM
Mircea Pitici	Senior Seminar	Graduate Student	Education
Paul Velleman	Math Awareness Month	Faculty	ILR

Francesca Crannell	Math Explorers Club Activities	Teacher	Lansing Middle School
Benjamin Greenman	Math Explorers Club Activities	Undergraduate Junior	ILR
Anthony Hawkins	Math Explorers Club Activities	Undergraduate Sophomore	Physics Major
Jasdeep Singh Hundal	Math Explorers Club Activities	Undergraduate Senior	Computer Science Major
Benjamin Kirk	Math Explorers Club Activities	Teacher	Ithaca High School
Christine Klee	Math Explorers Club Activities	Teacher	Cohen M.S. (Elmira Hts)
Xing Lu	Math Explorers Club Activities	Undergraduate Junior	Math & Economics Major
Robert Ravier	Math Explorers Club Activities	Undergraduate Junior	Math Major
Yipu Wang	Math Explorers Club Activities	Undergraduate Junior	Math & Computer Science Major
Wendy Zeng	Math Explorers Club Activities	Undergraduate Sophomore	Math & Economics Major
Anna Bertiger	JHU CTY	Graduate Student	Mathematics
Adam Bjorndahl	JHU CTY	Graduate Student	Mathematics
Diarmuid Cahalane	JHU CTY	Graduate Student	CAM
Timothy Healey	JHU CTY	Faculty	Mathematics, Mechanical & Aerospace Engineering
Matthew Holden	JHU CTY	Graduate Student	CAM
Sumedh Joshi	JHU CTY	Graduate Student	CAM
Robert Kesler	JHU CTY	Graduate Student	Mathematics
Isabel Kloumann	JHU CTY	Graduate Student	CAM
Ravi Ramakrishna	JHU CTY	Faculty	Mathematics
Kathryn Sullivan	JHU CTY	Graduate Student	CAM
Laura Escobar Vega	JHU CTY	Graduate Student	Mathematics
Dana Warmsley	JHU CTY	Graduate Student	CAM
Elizabeth Wesson	JHU CTY	Graduate Student	CAM
Kyle Wilson	JHU CTY	Graduate Student	CAM
Anastasia Raymer	Puzzle Nights	Faculty	Mathematics
Kristen Pueschel	4-H Career Explorations	Graduate Student	Mathematics
Danielle Toupo	4-H Career Explorations	Graduate Student	CAM
Richard Rand	Lansing HS Math Club	Faculty	Mathematics, Mechanical & Aerospace Engineering
Steven Strogatz	Communicating Mathematics to the Public	Faculty	Mathematics, Mechanical & Aerospace Engineering
Matthew Holden	NYS Fair	Graduate Student	CAM
Matthew Holden	NYS Fair	Graduate Student	CAM
Sarah Iams	NYS Fair	Graduate Student	CAM
Isabel Kloumann	NYS Fair	Graduate Student	CAM
Eoin O'Mahony	NYS Fair	Graduate Student	Computer Science
Vasu Raman	NYS Fair	Graduate Student	Computer Science
Rocio Ruelas	NYS Fair	Graduate Student	Computer Science
Maarika Teose	NYS Fair	Graduate Student	CAM
Chenxi Wu	IHS Math Team	Graduate Student	Math
Jason Anema	AMC Competition	Graduate Student	Mathematics
Lucien Clavier	Partner School in Tucson, AZ	Graduate Student	Mathematics
Jasdeep Singh Hundal	Partner School in Tucson, AZ	Undergraduate Senior	Computer Science Major