



MathILy-Er 2018 Final Report

Preface

This was the fourth year of MathILy-Er. As usual, our students were awesome and we did a ton of math.

Program Preparations

Promotions

Emails: Individual emails were sent to promising applicants from 2017 inviting them to apply for 2018. MathILy-Er 2017 participants were emailed as a group notifying them when the EAR became available.

Webpage hits: From September through December 2017, web traffic was 2400–2800 hits per week; over January–March 2018 the hit count climbed to 3000–3200 hits per week, and over April and May dropped down to 2000 hits/week, where the traffic stayed through August 2018.

Impacts: About 54% of applicants found {MathILy, MathILy-Er} on a summer program list, 34% via a web search, 27% from a parent or guardian, 15% from a teacher, and 4% from a flier. More students found {MathILy, MathILy-Er} via a summer program list or via a web search than last year, while fewer were informed by a teacher. About 5% of applicants said they heard about {MathILy, MathILy-Er} from a friend or relative who had attended.

Applications

Statistics: 125 of the 247 completed applications were forward for MathILy-Er consideration, and of those 42 were admitted and 29 attended. That’s an admissions rate of 34% and a yield of 69%.

The data in the following table was measured where possible and approximated otherwise.

Percentage 2018	Female	East Asian	South Asian	Latin@	Other of color
Short Forms	40%	39%	19%	4%	2%
EARs	34%	44%	13%	1%	1%
Attending	27%	44%	3%	6%	0%

Financial Aid: We were able to award \$19,900 in financial aid to MathILy-Er participants (\$16,800 to domestic students and \$3,100 to international students). All admitted students’ demonstrated need was met.

Personnel

Academic: There were three Lead Instructors, Dr. Jonah Ostroff (University of Washington, Ph.D. Brandeis University 2013), Dr. Alice Mark (Rutgers University, Ph.D. University of Texas at Austin 2015), and Dr. Noah Forman (University of Washington, University of California Berkeley 2013), with Noah teaching only during the third week. There were four Apprentice Instructors, Dr. Cathy Hsu (University of Bristol, Ph.D. University of Oregon 2018), Lucas Van Meter (University of Washington), Arianne Hermida (Smith College), and Evan Forletta (University of California Santa Cruz).

Administrative: The Director was Dr. Jonah Ostroff. The {MathILy, MathILy-Er} Minion was Madison Stuart (Smith College B.A. 2006 in Mathematics and German; graduate work in information science at the University of Michigan). The Protector and Responder in the MathILy-Er Environment (PRiME) was Pavani Rannulu (B.A. University of Maryland 2018).

Advisory Amalgam: These individuals gave advice on academic and practical aspects of MathILy.

[Dr. Douglas J. Shaw](#), mathematics faculty at University of Northern Iowa

[Dr. Ruth Haas](#), mathematics faculty at University of Hawaii

[James Cocoros](#), mathematics faculty at Stuyvesant High School

[Dr. Dylan Shepardson](#), mathematics faculty at Mount Holyoke College

[Dr. Carol E. Fan](#), operations researcher (currently Director of Operations Research at [SoFi](#))

[Dan Zaharopol](#), Executive Director of [BEAM](#)

[Dr. James Tanton](#), mathematician, currently Ambassador for the [MAA](#)

[Dr. Joshua Greene](#), mathematics faculty at Boston College

[Dr. Emily Peters](#), mathematics faculty at Loyola University Chicago

[Wing L. Mui](#), mathematics faculty at the Overlake School

[Dr. Thomas Hull](#), mathematics faculty at Western New England University

[Dr. Josh Laison](#), mathematics faculty at Willamette University

Student Demographics

States represented by MathILy-Er students, from east to west: Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Virginia, Florida, Georgia, Michigan, Alabama, Illinois, Minnesota, Texas, Arizona, Idaho, California, Oregon

Countries outside the United States: Turkey, Ukraine, Canada

Gender breakdown: 8 females, 21 males.

Ages: There were seven 14-year olds, one of whom turned 15 during the program; six 15-year olds; eight 16-year olds; and eight 17-year olds.

What Happened at MathILy-Er 2018?

Academics

Classes: Each weekday we had 4 hours of morning class, 1 hour of Daily Gather, and 3 hours of evening problem session, for at least 8 contact hours per day (not including mathematical conversations held outside of class). Weekends varied, but Saturdays usually consisted of 4 hours of morning class and 2 hours of life seminar.

The basic curricular structure was two weeks of core curriculum, called Root Class (after the Root of a graph theoretic tree, and after the idea that the material strengthens student grounding much as the roots of a tree do), followed by one week of short topical classes, called the Week of Chaos, followed by two weeks of focused-topic class, called Branch Class (after branches of mathematics, and after the idea that tree branches grow from a strong trunk nourished by roots).

Root Class: The 29 students were split into two root classes (one taught by each LI). The material in Root Class included matrix algebra and ring theory, enumerative combinatorics, graph theory, and combinatorial game theory. All of this material was treated with full proofs given by the students.

Week of Chaos: Students indicated which of 37 potential topics they would be excited to learn about. Instructors compiled these favorites into a set of fifteen courses. The courses offered were as follows: Hard Problems (algorithms and computability), Cryptography, Hyperplane Arrangements, Cardinal & Ordinal Numbers, Auctions, Random Symmetry, Complex Numbers, Markov Chains, Forbidden Patterns, Surfaces, p -adic Numbers, A Tour of Turing, Expected Value, Convex Geometry & Polyhedra, Number Theory, Rubik's Cubes, Generating Functions, and Methods of Proof. Each student was placed into five of these classes according to their expressed preferences. A majority of these classes used material from the Root curriculum

Branch Class: There were two Branch classes, on the topics of mathematical politics and non-Euclidean geometry.

Pedagogy: All classes were conducted through inquiry-based learning, with students writing on the board throughout most of the morning class, and almost zero time spent with instructors presenting at the front of the room.

Feedback: Students received feedback in several ways. Class presentations were often met with verbal feedback from instructors and students, both for mathematical correctness and style. Students received written comments on their problem session work at the beginning of the following morning class. Near the end of Root and Branch classes, students wrote self-evaluations on their progress at MathILy-Er. Finally, individual interviews were held with the students on three points during the summer.

Daily Gatherers: Most instructors gave one or more Daily Gatherers. The Daily Gather time slot was occasionally used for other activities, such as math movies or a Sage tutorial. The remaining Daily Gatherers were interactive presentations by visiting mathematicians, including visiting staff from MathILy and an Bowdoin undergraduate research group.

Extracurriculars

Life Seminars: Two Life Seminars were held on weekend afternoons. Each of these was an unstructured two-hour period where students could ask the staff about applying and going to college, work as a mathematician, and general practical matters of life and adulthood.

Other program-wide activities: At the end of the first week, students and staff explored a nearby park in Brunswick. At the end of the third week, students and staff took a day trip to Portland. Towards the end of the program, there was an informal talent show.

Non-program-wide activities: Student recreational activities included running, foosball, ultimate frisbee, and piano. Students often played board games in the lounges.

Administrative matters:

Facilities at Bowdoin: The dorm and classrooms at Bowdoin were less nice than at Willamette, but it was still an adequate campus. The dining hall was excellent.

Brunswick: Brunswick was a nice town for the program, with a variety of restaurants and shops for students to explore on weekends. The proximity to Portland made it much easier to pick up students and visitors from the airport than in previous years, although the small size of the airport made it harder to schedule some flights.

Post-Processing

Post-program staff meeting: On Saturday afternoon after students left, the staff met to discuss various aspects of the summer.

We were very happy with the Root curriculum, and in particular felt that the graph theory changes from last year went well.

Collectively, we felt that the students showed a promising amount of growth, and that many would be ready to attend MathILy should the apply in the following summer.

Finances summary: The income from student fees was \$113,640 and a grant for financial aid was \$5,000. Additional donations brought the total MathILy-Er income to \$119,040.

Administrative expenses (insurance, fliers, etc.) totaled approximately \$1808.

Total wages (instructors, PRiME, Minion, Director) were approximately \$39,214.

Travel costs (Daily Gather speakers, instructors) were approximately \$2,620.

Program expenses (supplies, program outings) were approximately \$1,907.

The charges from Bowdoin were approximately \$80,104 for food, housing, and copying costs.

Thus, the total expenses were approximately \$125,653. The cost overrun was primarily due to financial aid needs.