ASSOCIATION FOR WOMEN IN MATHEMATICS

Newsletter

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The purpose of the Association for Women in Mathematics is to create a community in which women and girls can thrive in their mathematical endeavors, and to promote equitable opportunity and gender-inclusivity across the mathematical sciences.

IN THIS ISSUE

PRESIDENT'S REPORT

As we step into another dynamic season, I am reassured by the strides our association continues to make in advancing the voice and presence of women in mathematics. Guided by our renewed mission—to create a community where women and girls can thrive in their mathematical endeavors and to promote equitable opportunity and gender inclusivity across the mathematical sciences—AWM remains dedicated to fostering a supportive, empowering environment for all.

A recent highlight was the Hidden Figures Congressional Gold Medal Ceremony, which honored Katherine Johnson, Dorothy Vaughan, and Mary Jackson. These trailblazing mathematicians paved the way for women, especially women of color, in STEM, and their legacy remains a beacon for our community. Their resilience and achievements exemplify the strength and courage we strive to uphold in AWM, underscoring our commitment to gender inclusivity and equitable opportunities for all mathematicians.

I was also honored to participate in a fireside chat at the SIAM Conference on Mathematics of Data Science, discussing the transformative potential of the CHIPS and Science Act for Data Science and AI. Joined by Shree Taylor of Elder Research and Frances Williams of Clark Atlanta University, we explored how this landmark legislation can shape the future of data science research, workforce development, and opportunities in STEM. It was inspiring to engage with leaders dedicated to creating an inclusive, innovative future for mathematics and its applications.

Looking ahead, I am thrilled to invite you to join us at the upcoming Joint Mathematics Meetings (JMM) in Seattle from January 8–11, 2025. AWM will host a rich lineup of events, including special sessions on topics such as Women in Mathematical Biology, Exploring Mathematics through the Arts, and the intersection of AI and Women+ in the Mathematical Sciences. The AWM-AMS Noether Lecture, delivered this year by Neena Gupta of the Indian Statistical Institute, promises to be a highlight. We'll also host our annual business meeting, awards ceremonies, workshops, a poster presentation session for women graduate students, and a networking reception. I encourage all members to participate, connect, and celebrate our shared achievements.

As I prepare to transition out of the role of President, I am honored to pass the torch to Raegan Higgins of Texas Tech University, who will lead AWM into its next chapter. Higgins brings a wealth of experience, dedication, and vision, and I am confident that under her leadership, AWM will continue to flourish, inspiring and supporting women mathematicians across the globe.

Talitha Washington

Serving as President has been an immense honor, and I am proud to have worked alongside such a dedicated community. Together, we are building a future where mathematics flourishes as a vibrant, inclusive field, enriched by a broad range of perspectives, groundbreaking innovation, and unwavering support for everyone committed to its growth. Our collective efforts continue to inspire and uplift me, and I look forward to continuing my mathematical journey with you. Thank you.

Talitha Washington

Talitha Washington, November 11, 2024, Atlanta, GA

ASSOCIATION FOR WOMEN IN MATHEMATICS

AWM was founded in 1971 at the Joint Meetings in Atlantic City.

The *Newsletter* is published bi-monthly. Articles, letters to the editor, and announcements are welcome. Authors sign consent to publish forms. The electronic version is freely available at awm-math.org.

Opinions expressed in *AWM Newsletter* articles are those of the authors and do not necessarily reflect opinions of the editors or policies of the Association for Women in Mathematics.

Circulation: 3500.

AWM at MAA MathFest

Lakeshia Legette Jones, AWM Meetings Coordinator, and Jeanette Shakalli, AWM MAA MathFest Committee Chair

The Mathematical Association of America hosted MAA MathFest 2024 in Indianapolis, from August 7 through August 10.

Deanna Needell (University of California at Los Angeles) delivered the 2024 AWM-MAA Etta Zuber Falconer Lecture, *Towards Fairer-ness in Machine Learning* on Thursday morning. Those in attendance were treated to interesting examples of successes and failures of machine learning applied to image analysis and in the modeling of vector-borne diseases such as Lyme disease. Linear algebraic tools for learning that include tailored approaches for fairness were described and new directions in fairness that allow for population subgroups to have better predictors than when treated within the population as a whole were presented. A recording of Professor Needell's talk is available on the MAA's YouTube Channel: https://youtu.be/cCw6lqL2TeU?si=a5pZZpZx4eSA-71A

Needell also organized an associated AWM-MAA invited paper session, *Iterative and Sketching Approaches for Linear Systems and Beyond*, that took place on Thursday and Friday and featured the following talks:

- A Multiplicative Algorithm for Curvature Corrected Semi-non-negative Matrix Factorization of Manifold-valued Data
  Joyce Chew, *University of California, Los Angeles*
- Randomized Kaczmarz Method for Linear Discriminant Analysis
  Jocelyn Chi, *Rice University*
- Variable Projection Methods for Large-scale Separable Nonlinear Inverse Problems
  Malena Español, *Arizona State University*
- Tensor Completion for Low CP-Rank Tensors via Random Sampling
  Santhosh Karnik, *Michigan State University*
- Stochastic Iterative Methods for Online Rank Aggregation from Pairwise Comparisons
  Lara Kassab, *University of California, Los Angeles*
- Randomized Gauss-Seidel and Column-Slice-Action Methods for Tensor Problems
  Alona Kryshchenko, *California State University Channel Islands*
- Iterative Approaches for Tensor Linear Systems
  Anna Ma, *University of California, Irvine*
- Kaczmarz based Iterative Hard Thresholding Techniques for Low-Rank Tensor Recovery
  Shambhavi Suryanarayanan, *Princeton University*
- Robust, Randomized Preconditioning for Kernel Ridge Regression
  Robert Webber, *California Institute of Technology*

On Friday afternoon, the AWM Education Committee (**Vilma Mesa**, *University of Michigan*, **Rachel Chaphalkar**, *University of Wisconsin-Whitewater*, **Raechel Kenney**,

Purdue University, **Elsa Medina**, *Cal Poly San Luis Obispo*, and **Dante Tawfeeq**, *John Jay City University of New York*) organized a panel discussion, *How to Hire a Math Educator: Considerations for Mathematics Departments*.

For the conference, the AWM Committee on MAA MathFest (**Janet Fierson**, *La Salle University*, **Buna Sambandham**, *Utah Tech University*, **Julia Yael Plavnik**, *Indiana University Bloomington*, **Sarah Kerrigan**, *George Fox University*, **Mariana Smit Vega**, *Western Washington University*, and **Jeanette Shakalli**, *FUNDAPROMAT, Panamanian Foundation for the Promotion of Mathematics*) organized a panel on mental health in the mathematics community and a workshop on games and puzzles.

Even though it was scheduled for the last day of MathFest, the workshop *Mathematical Games and Puzzles: Fun For All!* was full of faculty, students, and other members of the mathematics community of all ages. The workshop featured the special participation of extraordinary mathematicians like Michael Dorff, Annalisa Crannell, Karl Schaffer, Ben Orlin, Dave Richeson, Carolyn Yackel, Fumiko Futamura, Ron Taylor, Timothy Goldberg, Joyati Debnath, Buna Sambandham, Sarah Kerrigan, Phil Yasskin and Jeanette Shakalli, who brought their favorite games and puzzles to share with other math enthusiasts. The positive feedback received from this AWM-sponsored workshop has been overwhelming.

On that same afternoon, the AWM-sponsored panel entitled *Mental Health in the Mathematics Community: Continuing the Conversation* took place. Invited panelists **Allison Henrich** (*Seattle University*), **Michael Dorff** (*Brigham Young University*), **Geillan Aly** (Compassionate Math), and **F. Taína Amaro** (Licensed Clinical Social Worker) shared their personal experiences and observations on how they face challenges with work-life balance and how these challenges have affected their mental health/well-being. Moderator **Jeanette Shakalli** then posed the question to all four panelists on how they take care of themselves. Geillan Aly shared strategies that she recommends on how to help people work through

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Membership Dues

Membership runs from Oct. 1 to Sept. 30
Individual: $70/$100 **Family:** $40
Contributing: $160/$190
New member, affiliate and reciprocal members, retired, part-time: $35
Student: $25 **Unemployed:** $20
Outreach: $10
AWM is a 501(c)(3) organization.

Institutional Membership Levels

AWM offers a tiered pricing structure for institutional memberships in six categories. Higher levels are:
Supporting Institutions: $750+ and
Sponsoring Institutions: $3000+
See awm-math.org for details.

Executive Sponsorship Levels

$5000+
$2500–$4999
$1000–$2499
See awm-math.org for details.

Print Subscriptions and Back Orders—Regular and contributing members living in the US may elect to receive a print version of the *Newsletter.* Libraries, women's studies centers, non-mathematics departments, etc., may purchase a subscription for $75/year. Back orders are $20/issue plus shipping/handling ($5 minimum).

Payment—Payment is by check (drawn on a bank with a US branch), US money order, or international postal order. Visa and MasterCard are also accepted.

Newsletter Ads—AWM will accept advertisements for the *Newsletter* for positions available, programs in any of the mathematical sciences, professional activities and opportunities of interest to the AWM membership and other appropriate subjects. The Managing Director, in consultation with the President and the Newsletter Editor when necessary, will determine whether a proposed ad is acceptable under these guidelines. *All institutions and programs advertising in the Newsletter must be Affirmative Action/Equal Opportunity designated.* Institutional members receive discounts on ads; see the AWM website for details. For non-members, the rate is $130 for a basic four-line ad. Additional lines are $16 each. See the AWM website for *Newsletter* display ad rates.

Newsletter Deadlines

Editorial: 17th of January, March, May, July, September, November
Ads: Feb. 1 for March–April, April 1 for May–June, June 1 for July–August, August 1 for September–October, October 1 for November–December, December 1 for January–February

Addresses

Send all queries and all *Newsletter* material except ads and material for columns to Dandrielle Lewis, awmnewslettereditor@awm-math.org. Send all book review material to Marge Bayer, bayer@ku.edu. Send all education column material to Jackie Dewar, jdewar@lmu.edu. Send all media column material to Sarah Greenwald, appalachianawm@appstate.edu and Alice Silverberg, asilverb@uci.edu. Send all student chapter corner queries/material to Monica Morales-Hernandez, student-chapters@awm-math.org. Send everything else, including ads and address changes, to AWM, awm@awm-math.org.

their mathematical traumas and anxiety, while F. Taína Amaro mentioned some of the most common mental health challenges that she has addressed with people from the mathematical community and how she has approached these challenges with them. These initial remarks from the panelists made attendees feel welcome and set the tone for an interactive session. After this first portion of the event, attendees were invited to bring forward stories and/or questions of their own. There is no doubt that mental health remains a topic of widespread concern in the mathematics community. This session continued the conversation on the subject that was initiated through a panel at last year's MAA MathFest and resulted in an open and empathetic dialogue to raise awareness, inspire positive change, and improve the well-being of our unique and vibrant community. There was definitely a strong response from the attendees so there is always hope that there will be a third follow-up session!

Finally, the AWM Student Chapter Awards were announced at the MAA Dessert Reception. Chapters were recognized for their outstanding achievements in Community Outreach (*University of Mississippi*), Funding and Sustainability (*Colorado School of Mines*), Professional Development (*Purdue University*), and Scientific Excellence (*University of Alberta*). The winners were celebrated with dessert and lively conversation!

AWM had an exhibit booth throughout the meeting, where volunteers stopped by to promote the AWM, sell AWM merchandise and just hang out.

The Association for Women in Mathematics is grateful for the support and partnership of the Mathematical Association of America. We look forward to planning some exciting activities for next year's MAA MathFest in Sacramention in August of 2025! Many thanks for the generous funding from the National Science Foundation (NSF) through the Division of Mathematical Sciences (NSF-DMS 2113506), with which the AWM was able to provide travel support for many of the participants in the AWM-MAA MathFest Program.

ASSOCIATION FOR WOMEN IN MATHEMATICS

Student Chapter Awards 2025

What projects, events, or programs could your student chapter undertake in this new school year? We love hearing about and featuring these programs, so be sure to complete the end of year survey in May and nominate your institute for the 2025 Student Chapter Awards.

ASSOCIATION FOR WOMEN IN MATHEMATICS

AWM ONLINE

The *AWM Newsletter* is freely available online.

Online Ads Info: Classified and job link ads may be placed at the AWM website.

Website: https://awm-math.org
Updates: webmaster@awm-math.org

Media Coordinator
Kimberly Ayers, socialmedia@awm-math.org

AWM DEADLINES

RCCW Proposals: February 1 and July 1, 2025

AWM Essay Contest: February 1, 2025

AWM Travel Grants: February 15 and May 15, 2025

AWM Mentoring Travel Grants: February 15, 2025

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Anne Leggett to Receive the AWM Distinguished Service Award

The Association for Women in Mathematics is pleased to announce that the AWM Distinguished Service Award will be presented to **Anne Leggett**, Professor Emerita, Loyola University Chicago. This award is given occasionally in recognition of an individual who has promoted and supported women in mathematics through exceptional and sustained volunteer service to the AWM. This award will be presented at the Joint Mathematics Meetings (JMM) 2025 during the AWM Reception and Awards Presentation Friday, January 10, 5:00–6:30 pm, Grand Ballroom D, Sheraton Grand Seattle.

Citation

As the citations for past service awards show, AWM is fortunate in having many members who have given remarkable service to the organization. Even among these remarkable members, Anne Leggett stands out. She has edited the AWM's *Newsletter* for 46 years, from Volume 7, Number 5, September–October 1977 to Volume 54, Number 1, January–February 2024. Anne has been an important part of AWM's institutional structure and memory in numerous ways, among them: her service on the Executive Committee since 1977, Infrastructure Task Force (2004–2005), Policy & Advocacy Committee (2008–2015), work on the *Executive Committee Handbook*, and maintenance of photo archives, making them available for the AWM anniversary volume *Fifty Years of Women in Mathematics*.

The AWM *Newsletters* document the frustrations, efforts, and progress of women in mathematics over the decades. Many of the themes that appear in the *Newsletter* are explicit in *Complexities: Women in Mathematics*, a prize-winning book edited by Leggett together with Bettye Anne Case, and published by Princeton University Press in 2005. Many of the articles in *Complexities* have been drawn from the *Newsletters* and thoughtfully annotated. Like the *Newsletters*, *Complexities* documents the collective history and wisdom of women in mathematics, ensuring that they are available to junior mathematicians and later generations.

With time and technological change, the *Newsletter* has metamorphosed in format and layout, and the *Newsletter* team has expanded. The duration of the current team is itself notable: Marge Bayer (book review editor since 2003), Cindy Dyer (graphic designer since 2005), Alice Silverberg and Sarah Greenwald (media column co-editors since 2009; Greenwald was associate editor, 2011–2024), Jackie Dewar (in charge of the education column since 2009, and column editor since 2012). At the same time, the *Newsletter* remains a home for sporadic columns (Student Chapter Corner, Mathematics + Motherhood), and, of course, articles and letters to the editor, helping us all to make new connections and maintain old ones.

Response from Anne Leggett

Many thanks to AWM for this wonderful honor, and also to the multitude of people who have worked with me over all these years. I treasure the friendships that I've made and strengthened. I made it through 46 years by agreeing to 23 terms of 2 years each (I was expecting just one term when I started out!), and each time I re-upped there were folks doing their bits to encourage me to keep on truckin'. I had a team of sorts from fairly early on, with column editors or people writing a series of articles on some theme or other, but it made quite a difference for me when we formalized the Newsletter Team. And although I knew it would be great to have an Associate Editor, it was a revelation to actually have one! Thanks to Sarah, and Alice and Jackie and Marge, and to past presidents who were always available after their official terms were over, especially Cathy Kessel and the late Georgia Benkart. My late husband Gerry McDonald was another wonderful helper, who was as happy as I was when I no longer needed to produce camera-ready copy and he no longer needed to get me to FedEx on time!

This latter change was one of many that evolved along with all that was going on with computer technology. Without those improvements I would never have lasted this long. Backspacing for error correction … virtual cut-and-paste … email replacing snail mail (and the dreaded taking of dictation over the phone) … my very own laser printer … the list goes on. There were of course also many changes in language and copyediting rules: years of putting periods into U.S. and Ph.D. followed by years of taking them out; changes in vocabulary with respect to race and gender.

Changes in the status of women in the profession have also been significant. When I got my degree in 1973, about 6% of PhDs in the mathematical sciences went to women. Although the present plateau in the percentages is not what we all may have hoped for back-in-the-day, it's sure a lot better now than it was then, with accompanying increases of percentages of women in leadership positions in the mathematical societies and in academe. There were many good changes over these 46 years in the political and cultural landscapes that I hoped would lead to more and more improvement; it's hard to see so much reversal, not just in this country, but world-wide. I hope that those editors who succeed me will see better times again to celebrate in our publications.

It is certainly the case that AWM and similar organizations are still very much needed. Although retired from my editorial position, I'll be cheering you on from the sidelines.

Mei Yin to Receive 2025 AWM Service Award

Photo by Natasha Dobrinen

The Association for Women in Mathematics is pleased to announce that the 2025 AWM Service Award will be presented to **Mei Yin**, Professor of Mathematics, University of Denver. Yin is being recognized for founding and leading the AWM Student Chapter at the University of Denver for the past nine years, for supporting the AWM Women in Algebraic Combinatorics (WiAC) Research Network, and for her contributions to the NSF ADVANCE grant, Mobilizing Equity to Raise Inclusivity in STEM (MERISTEM). This award will be presented at the Joint Mathematics Meetings (JMM) 2025 during the AWM Reception and Awards Presentation, Friday, January 10, 5:00–6:30 pm, Grand Ballroom D, Sheraton Grand Seattle.

Citation

Over the years, Mei Yin has contributed extensively to the regional and national AWM network. While a postdoc at Brown University, Mei co-organized an Inspiring Women in STEM panel discussion that drew attendance from neighboring universities in the Northeast. Mei served as a judge for the AWM-MfA Student Essay Contest in 2014, 2016, and 2019 and as a judge in the AWM Poster Presentations at the JMM in San Antonio in 2015. Mei has been a mentor in AWM's Mentor Network since 2017 and has kept in contact with some of her mentees well after the official mentor period ended, giving them continued support. Mei was a member of the AWM's Social Media Committee from February 2021 to January 2024.

In January 2016, as a tenure-track assistant professor, Mei founded the University of Denver (DU) Student Chapter of the AWM and has served as the faculty advisor for the chapter since then. The chapter has been quite active since day one. Every academic quarter the chapter sponsors a mentoring lunch and a mentoring tea at which Mei and the student officers select a topic for discussion such as "How to embrace opportunities and challenges for the next stage of your academic journey," "How to best support students needing accommodations," or "How to write successful papers and grant proposals." The chapter also hosts signature events throughout the year. Some of these events are social, such as sushi making and pumpkin carving, while others are educational, such as the distinguished speaker series and undergrad women award ceremonies. In 2021, the DU AWM Student chapter was featured on the AWM 50th Anniversary Website (https://awm-math.org/50th-anniversary/).

Mei has supported the research development of many women and underrepresented students locally and beyond, through leading independent studies, organizing workshops and conferences, and writing joint papers. Mei is an active member of the WiAC Research Network, and was an invited participant in the January 2024 workshop held at Banff International Research Station. The DU-MERISTEM program, supported by an NSF ADVANCE grant, is a coalition of DU faculty and staff working to address underrepresentation of women and other marginalized groups among STEM faculty. Mei is a steering committee member for the program and serves as a mentor in the New Faculty in STEM Mentoring Program.

Response from Mei Yin

It is truly an honor and privilege to be a recipient of the AWM service award. The AWM has been graciously providing us with encouragement, support, and a sense of community for over 50 years. I would like to thank the many students who have been actively involved in our AWM Student Chapter at the University of Denver. I also wish to acknowledge the women colleagues who have led me, mentored me, and worked with me over the years, with special thanks to Mary Clark, Corinne Lengsfeld, Susan Petersen, Anna Sher, Natasha Dobrinen, and Susan Bolton. I look forward to continuing my efforts of supporting the AWM mission of promoting equitable opportunity and gender-inclusivity in the mathematical sciences, both locally and beyond.

The AWM Service Award, established by the AWM Executive Committee in November 2012, recognizes individuals for helping to promote and support women in mathematics through exceptional voluntary service to the Association for Women in Mathematics. The award is given annually to a select AWM volunteer or group of AWM volunteers in recognition of their extensive time and effort devoted to AWM activities.

Kuei-Nuan Lin to Receive 2025 AWM Service Award

The Association for Women in Mathematics is pleased to announce that the 2025 AWM Service Award will be presented to **Kuei-Nuan Lin**, Associate Professor of Mathematics at Penn State Greater Allegheny. Lin is being recognized for her leadership of the AWM Mentor Network program, for her service on the Education and Outreach Portfolio Committee and on the AWM-NSF Travel Grants Selection Committee, and for her work as an Associate Editor for the *2022 AWM Symposium Proceedings* volume. Lin also serves as President of American Association of University Women Pittsburgh Branch. This award will be presented at the Joint Mathematics Meetings (JMM) 2025 during the AWM Reception and Awards Presentation, Friday, January 10, 5:00–6:30 pm, Grand Ballroom D, Sheraton Grand Seattle.

Citation

The AWM Mentor Network Program was established in 2001 and matches around 150 volunteer mentors each year with girls and women who are interested in mathematics or are pursuing careers in mathematics. The network links mentors with a variety of groups: faculty at all ranks, post docs, graduate students, undergraduates, high school and middle school students, teachers, and research scientists. Matching is based on common interests in careers in academics or industry, math education, balance of career and personal life, or general mathematical interests.

Lin has been a member of the Mentoring Network Committee since 2021 and has served as chair since 2023. When she took over as chair, she immediately hired a student assistant and organized the work in an efficient and professional manner. Communications between mentors and mentees have significantly improved under Kuei-Nuan Lin's leadership. Lin is always thinking about ways to improve the program and routinely solicits mentors.

As a member of the Education and Outreach Portfolio, Lin listens to others and often makes exceptionally insightful suggestions to help resolve issues the other members are having with their programs. She happily takes on additional responsibilities such as reviewing the K-12 resources on our webpage, serving as a mentor for graduate students as part of the Women in Commutative Algebra (WICA) workshop at JMM 2023, and speaking to a high school club from Tsinglan International School in Dongguan, China.

A regular contributor to the AWM Research Symposium, Lin volunteered to be an Associate Editor of *2022 AWM Research Symposium Proceeding*, guiding less experienced colleagues in the work of editing such a volume, and has stepped up to advise editors of future volumes. Lin currently serves on the AWM Travel Grant Selection Committee.

Kuei-Nuan Lin is a consistent, reliable, and thoughtful volunteer, mentor, and community member, who always says "yes, I can do that," and then follows through with wisdom, kindness, and professionalism.

Response from Kuei-Nuan Lin

I am deeply honored to receive the AWM Service Award. AWM has had a tremendous positive impact on my professional journey through its extensive network of mentors, travel grants, research symposiums, and valuable research networks and proceedings. Personally, AWM has enriched my life with meaningful friendships, educational resources for K-12 students, essay competitions, and initiatives like EvenQuads, which have been instrumental in raising my children. It is a privilege to give back to this extraordinary community, and I am excited about the opportunity to collaborate with all the dedicated volunteers at AWM. A special thank you to Darla Kremer and the committee members for this wonderful opportunity to serve.

The AWM Service Award, established by the AWM Executive Committee in November 2012, recognizes individuals for helping to promote and support women in mathematics through exceptional voluntary service to the Association for Women in Mathematics. The award is given annually to a select AWM volunteer or group of AWM volunteers in recognition of their extensive time and effort devoted to AWM activities.

The AWM Fellows Program

I am pleased to announce the 2025 AWM Fellows, a group of extraordinary colleagues who have dedicated themselves to strengthening the mathematical community. Please join me in honoring them at the AWM Awards Reception on Friday, January 10, 5:00–6:30 pm, Grant Ballroom D, Sheraton Grand Seattle.

—Talitha Washington, AWM President

2025 Class of AWM Fellows

Katrina Barron, *University of Notre Dame*, For her tireless advocacy for gender equality, mentorship of women in algebra, representation theory, and mathematical physics, and active participation and leadership in initiatives aimed at supporting women in mathematics.

Marianne Korten, *Kansas State University*, For her deep commitment to diversity and access in mathematics, supporting the diverse personal lives of mathematicians as students and faculty, helping us achieve success through AWM forums, online mentoring, regional advocacy, and summer research programs

Kathryn Leonard, *Occidental College*, For her many contributions to increasing opportunities and accessibility for women in mathematics through such roles as president of AWM (2021-2023), board member for STEAM:CODERS, and leadership in AWM Research Networks, as well as her contributions to expanding research opportunities in both certificate and degree granting higher educational institutions through the Center for Undergraduate Research in Mathematics.

Fengyan Li, Rensselaer, *Polytechnic Institute*, For her continuous and enduring contribution to the promotion of women in computational mathematics through her service to AWM, mentorship of young women scientists, and development of training opportunities as well as platforms for women to connect such as WINASc.

Guozhen Lu, *University of Connecticut*, For his sustained support and service to AWM, mentorship of early and mid-career female scientists, and advocacy in the career advancement of talented female mathematicians, including recognition in the form of honors and awards.

Lillian B. Pierce, *Duke University*, For her many contributions in the support of women both locally and nationally through the organization of such events as "Re:boot Number Theory," "A room of one's own," and GROW.

Magdalena Daniela Toda, *Texas Tech University*, For her outstanding leadership in supporting women and girls in mathematics, most notably through the longstanding Emmy Noether High School Days, as well as her service to AWM and local and national committees working towards equity.

NSF-AWM Travel Grants for Women

Mathematics Travel Grants. The objective of the NSF-AWM Travel Grants is to enable women mathematicians to attend conferences in their fields, which provides them a valuable opportunity to advance their research activities and their visibility in the research community. Having more women attend such meetings also increases the size of the pool from which speakers at subsequent meetings may be drawn and thus addresses the persistent problem of the absence of women speakers at some research conferences. The Mathematics Travel Grants provide full or partial support for travel and subsistence for a meeting or conference in the applicant's field of specialization.

Selection Procedure. All awards will be determined on a competitive basis by a selection panel consisting of distinguished mathematicians appointed by the AWM. A maximum of $2300 for domestic travel and of $3500 for foreign travel will be funded. For foreign travel, US air carriers must be used (exceptions only per federal grants regulations; prior AWM approval required).

Eligibility and Applications. Please see the website (https://awm-math.org/awards/awm-grants/travel-grants/) for details on eligibility and do not hesitate to contact awm@awm-math.org or 401-455-4042 for guidance. Applications from members of underrepresented minorities are especially welcome.

Deadlines. There are three award periods per year. Applications are due **February 15**, **May 15**, and **October 1**.

BOOK REVIEW

Book Review Editor: Margaret Bayer, University of Kansas, Lawrence, KS 66045-7523, bayer@ku.edu

Gender in STEM Education in the Arab Gulf Countries
Martina Dickson, Melissa McMinn, and Dean Cairns, Editors. Springer, 2023. ISBN 978-9811991349. Hardcover.

Reviewer: Elizabeth A. Lamprecht, Adrian College, Adrian, MI 49221, elamprecht@adrian.edu

Although my formal background is in mathematics, and I have worked as an undergraduate math generalist for many years, over time, I have developed an increasing interest in the important role that women have played in the fields of math, science, and science education. In fact, in recent years, I have branched out and developed myself as both an historian and writer. In Fall 2010, I taught the course *History of Mathematics* for the very first time. And, in Spring 2015, I introduced another course to my college's curriculum. This course, *Women in Science and Mathematics*, currently satisfies the college's Writing Intensive and Humanities requirements. In addition, it serves as an elective in the Women and Gender Studies minor.

Indeed, my interest in this topic continues to this day, yet, despite having read numerous publications relevant to the struggles and contributions of women, it occurred to me that I knew relatively little about women's status and participation in STEM-based activities in the Persian Gulf. Fortunately, the text *Gender in STEM Education in the Arab Gulf Countries* has helped to fill this void. Moreover, it has convinced me of the urgent need to advocate for a more highly specialized workforce, one that is science-literate. In the coming years, humankind will need to address numerous environmental challenges: air and water pollution, deforestation, climate change, and ocean acidification, to name a few. As noted in Chapter 7, environmental awareness is associated with strong scientific literacy. Therefore, science and math education play a critical role.

In the foreword of *Gender in STEM Education in the Arab Gulf Countries*, the editors state that "gender imbalances still … persist in most STEM fields," and gender also "seems to impact a subject choice even within the STEM umbrella" (p. v). Globally, about one-third of STEM students are women. But what accounts for this marked gender disparity? Certainly, it "cannot be understood as the result of 'natural' biological differences" (p. v). For example, in Bahrain, women comprise 86% of natural science, mathematics, and statistics students. So, clearly, gender is not the deciding factor, and there is a need to "explore … the many facets of influence and experience that contextualize students' journeys" (p. v). This book provides such an exploration. In it, the editors draw attention to "the gendered dynamics of STEM education across different national contexts within the Gulf Region." The chapters utilize a variety of methodological tools and cover "a wide range of sectors and foci, … and across a range of contexts" (p. v). Without question, this research "has much to offer academics, policymakers, and practitioners" (p. v). It is a valuable resource.

As noted in the preface, STEM subjects "are at the top of most countries' national agendas." In fact, countries strive to increase "the key performance indicators (KPIs) related to STEM growth" (p. vii). National leaders recognize the need to invest in and prioritize a knowledge-based economy, one in which STEM jobs play a key role. As such, it is crucial that "we are drawing on the best possible pool of students and professionals" (p. vi). Undoubtedly, all students, regardless of their race/ethnicity, gender, disability, and/or socio-economic background, should be allowed to access "fields

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CALL FOR PROPOSALS

Research Collaboration Conferences for Women

The AWM works to establish and support research networks for women in all areas of mathematics research. In particular, the AWM RCCW Committee provides mentorship and support to new networks wishing to organize a Research Collaboration Conference for Women (RCCW). The Committee offers help finding a conference venue, developing and submitting a conference proposal, and soliciting travel funding for participants. Thanks to a National Science Foundation grant, some funding may be available through the AWM to support new RCCWs, especially interdisciplinary proposals and proposals that bring together researchers from traditionally underrepresented populations.

Mathematicians interested in organizing the first conference of a new RCCW are invited to submit a proposal to the AWM describing the conference topic, potential co-organizers and project leaders, and potential participants. Proposals should be no more than one page (PDF files only, please) and should be sent to awm.rccw@gmail.com. Deadlines for submission: **February 1** and **July 1**.

More information about Research Collaboration Conferences for Women, existing RCCW networks, and related initiatives can be found at http://awm-math.org/programs/research-networks/.

of education and employment they feel they can flourish in." It is a matter of human rights. (p. vi)

The text, *Gender in STEM Education in the Arab Gulf Countries*, consists of three parts, each with a different theme:

Part I consists of three chapters that focus on *STEM Beliefs and Identity*. Specifically, "Chapter 1 discusses ways in which STEM subjects have historically been perceived as being 'boys' subjects" (p. viii), and it lays the groundwork for future discussion. Of course, one's STEM beliefs impact one's science identity, and this in turn impacts one's self-efficacy. Interestingly, the authors present data which indicates that stereotypical attitudes may be changing in the Gulf Cooperation Council (GCC). The GCC is a political and economic alliance of six Middle Eastern countries—Bahrain, Kuwait, Oman, Qatar, Saudia Arabia, and the United Arab Emirates.

Chapter 2 addresses epistemological beliefs regarding the nature and acquisition of science knowledge, and considers how these beliefs impact males and females, their associated beliefs about learning, and their science achievement. Indeed, there are implications for the science classroom. (p. viii) This chapter outlines the practical implications for science teaching methodologies in United Arab Emirates (UAE) schools. As one might expect, teachers, and parents, are highly influential in shaping students' attitudes, achievement, and persistence in STEM.

Chapter 3 analyzes empirical data obtained using the "Draw a Scientist Test" (DAST). This tool, which has been called "a 'window' into children's … perceptions of scientists" (p. 62), was administered to 107 female students in Abu Dhabi, the capital and largest emirate of the UAE. Notably, participants' drawings "may suggest the dissolving of a predominant stereotype of female scientists" (p. 77), and they suggest "that science is perceived by the participants in this study as a career for women" (p. 78).

Part II, which consists of Chapters 4 through 7, considers *Attitudes and Understanding in STEM*. More specifically, it explores "attitudes towards, and understanding of, two other components of STEM, mathematics and technology." Of course, being a math educator, with a growing interest in technology, I found Part II of the book quite compelling. Chapter 4 provides a detailed analysis of the aims and results of a study which involved students in four all-girl schools in Abu Dhabi. This study, which employed a mixed-methods approach, was designed to compare students' perceptions and attitudes towards math when taught using exemplary inquiry-based learning, and more traditional methods. The results possibly suggest changing perceptions of middle school girls in the UAE towards the learning of mathematics.

Chapter 5 then follows with an in-depth exploration of math anxiety in females. (p. viii) In particular, this chapter discusses the history of math anxiety, how it is defined and measured, and its causes. Recommendations are also made for breaking the perpetual cycle of math anxiety in UAE national pre-service teachers. (p. 119)

What is more, Chapter 6 discusses gender differences in Information and Communication Technology (ICT) literacy, a competence which is crucial for success in STEM-related fields. Undeniably, ICT and STEM complement each other, with STEM providing a platform to apply ICT skills (p. 153-154). This chapter also considers relevant reforms and initiatives in the UAE (p. 153-154).

Chapter 7, the final chapter of Part II, questions "whether the future adult citizens of the Gulf countries" will be "well-informed of environmental issues" (p. viii). Undoubtedly, improved environmental outcomes are dependent upon quality science education. Both the UAE and Qatar "have committed to the United Nation's (sic) sustainable development goals (SDGs), which include SDG4 – Quality Education" (p. 174).

Part III, which consists of final two chapters of the book, addresses *"the experiences and representation of women in STEM* …, both as receivers/participants and as providers of STEM education" (p. viii). Specifically, Chapter 8 calls attention to the development of the knowledge economy in the GCC, "where highly competent leaders in STEM" are of "paramount importance" (p. 199). Unfortunately, the underrepresentation of women in leadership positions is a global phenomenon. For example, in Europe, women hold 21% of high executive positions in technology, and only 13% in engineering (p. 200). To be sure, underrepresentation is a multi-faceted issue. This chapter identifies four common barriers that women often encounter and "charts the narrative journeys of fifteen female leaders in STEM." Moreover, it "focuses on the role that schooling and university experiences have played." (p. 199) What factors and influences led to their success? Not surprisingly, teachers in school and faculty in higher education played a significant role. The support of family members was important too. These narrative stories, which involved female STEM leaders from the UAE, Oman, Kuwait, Bahrain, and Qatar, could serve as powerful references for girls and women in STEM, especially for those at the beginning of their journey. (p. 200)

Chapter 9, the book's final chapter, discusses the status of female leaders in higher education. Unfortunately, despite great gains in recent years, women are still underrepresented at the highest ranks. This chapter includes an analysis of staffing data in STEM departments in higher education institutions in the UAE. *Gender in STEM Education in the Arab Gulf Countries* concludes with a culmination of "all of the factors which could potentially lead to gendered (sic) imbalance within STEM fields in the Gulf region" (p. ix). As might be expected, these factors are almost universal.

Although this book is not a math or math education text, per se, I found it very informative, interesting, and dare I say, inspiring. I took copious notes as I read through the chapters in this volume. I would say it is the definitive source on its topic. I learned a great deal about educational research and became familiar with several new sampling methodologies. Furthermore, I learned about various methods of science-related assessment. For example, the Trends in International Mathematics and Science Study

(TIMSS) is used to measure student achievement in math and science and collects data "on students, teachers, schools, curricula, and education policies" (https://nces.ed.gov/timss/). Interestingly, in 2019, girls had higher TIMSS scores than boys *for science* in all six countries in the GCC. Girls' scores in math were higher in Oman, Bahrain, and Saudi Arabia.

Chapter 2: *Epistemological Beliefs About Science and Their Relations to Gender, Attitudes to Science and Science Achievement* in UAE Schools was also both instructional and thought-provoking. I read about important concepts in the philosophy of science and education and learned that "epistemological beliefs about science in science education remains a significant area of study" (p. 31). Interestingly, there is limited evidence regarding gender's influence on beliefs about science knowledge (p. 32). As one might expect, the authors emphasize "the importance of sophisticated epistemological beliefs for science learning." This makes sense, as scientific knowledge is ever evolving (p. 36). Not surprisingly, epistemological beliefs are possibly formed through early childhood experiences (p. 37), and overall enjoyment and motivation are the strongest predictors of scientific literacy (p. 31).

I should also emphasize that much of the text's discussion is data driven. For example, in Chapter 2, the authors present the results of a study that analyzed data from the Program for International Student Assessment (PISA) 2015 cycle. More specifically, the participants in the study attended government-funded schools in the UAE, and this chapter provides a detailed description of the methodology, analysis, and results of the study. PISA was created by the Organization for Economic Cooperation and Development (OECD) to test the skills and knowledge of 15-year-olds in mathematics, reading, and science. Eighty-one countries took part in the 2022 assessment, which focused on mathematics (https://www.oecd.org/en/about/programmes/pisa.html).

Only three of the chapters in this text directly pertain to mathematics education and technology. Nevertheless, the fields of math and science have much in common, and this book is a relevant one. Until recently, I felt quite sheltered and was not fully aware of educational efforts taking place in other parts of the world. For example, I did not know that research into the effectiveness of inquiry-based methods is being conducted globally. And I was not familiar with the efforts being made world-wide "to develop students' knowledge and awareness of environmental issues" (p. 175). In truth, I found the information presented in Chapter 7, *Understanding of Environmental Issues Across Two Gulf Countries: Do Girls Know More Than Boys in UAE Schools?*, to be the most interesting.

Furthermore, the issues raised in Chapter 8, *Female Stem Leadership in the Gulf: Journeys Through Education*, are of the utmost importance, and this is true regardless of whether one's discipline is mathematics or chemistry. In Chapter 8, the authors emphasize the significant role that women play in their country's educational system. And although some of the statistics are bleak, there is reason for hope. For example, in 2020, female students outnumbered male students in *all* STEM disciplines in the United Arab Emirates University, the first public university in the UAE. And, in 2017, 59% of computer science majors in Saudia Arabia were female. Regrettably, these good statistics do not "translate to similarly high proportions of women in the workplace" (p. 202). And, as suggested earlier, women are underrepresented in leadership positions, regardless of their home country.

So, what can be done to remedy this gender imbalance? For one, it is important to recognize the unique skill set that many women bring. Strong female role models are also indispensable for younger faculty and students. Chapter 9, *Gender Representations in STEM Departments in Higher Education Institutions in the UAE*, outlines the factors that contribute to the underrepresentation of women in higher education in the UAE. Not surprisingly, female academics in the Unites States face many of the same challenges. However, "the status of female professors in the UAE is more dire than in other countries" (p. 236), and the chapter concludes with some suggestions to help women rise through the academic ranks. The authors also encourage institutions to adopt "policies and practices that would encourage greater numbers" of women to pursue careers in higher education (p. 241).

In conclusion, *Gender in STEM Education in the Arab Gulf Countries* is an essential resource for anyone interested in the multi-faceted relationship between gender and STEM. What is more, it is written to have broad appeal. Educators, social scientists, and professionals from the various branches of STEM will find its content intriguing. Moreover, university professors, policymakers, and administrators will benefit from the information contained therein. Lastly, each chapter is followed by a lengthy bibliography, pointing the way for future research. I know that I will return to this book during my Spring 2025 sabbatical.

MEDIA COLUMN

Media Column Editors: Sarah J. Greenwald, Appalachian State University, appalachianawm@appstate.edu and Alice Silverberg, University of California, Irvine, asilverb@math.uci.edu

Mathematician Traits from an Egg Donor

Sarah J. Greenwald, Appalachian State University

In the Season 1, episode 9 episode of *Not Dead Yet*, an ABC show about an obituary writer who interacts with the deceased, there is a brief mention of a math degree. The scene doesn't involve the lead character.

Dennis is looking for an egg donor and is getting help from his two friends and colleagues, Lexi and Sam, who are already mothers. All three work at the newspaper. Dennis presents pictures of the candidates and they all agree that they are beautiful. The first candidate's info is briefly shown, such as National Merit Scholar and team captain of the diving team in high school.

At first Sam says that this candidate is really promising and they are excited that she graduated summa cum laude from Carnegie Mellon. "Yes, but, she has a degree in math,'" states Dennis. Lexi and Sam grunt negatively in response. In fact, a masters in mathematics is listed. Lexi warns: "Uu-uch... no you don't want some weird math baby vomiting their beautiful mind all over your pristine windows." The others agree and the candidate is ruled out as a donor as a result: "2+2=no."

I was surprised to see such a negative response to a math degree and I found it interesting that they assume that any disturbing mathematician traits would be passed from biological mother to child. They seemed quite happy about the possibility of an intelligent baby before the math degree was mentioned. So, their concern seems to be centered around stereotypes of mathematicians being peculiar. Initially, I also wondered if they were possibly suggesting a link to mental illness, since paranoid schizophrenia is portrayed in *A Beautiful Mind*, the movie Lexi references. However, when I looked more carefully at the candidate's info, it specifically noted "Mental health history: NA."

The next candidate has a bachelor's degree in literature but somehow shows "Academic awards: Abel Prize." I'm guessing that someone mistakenly put that there when they meant to list it with the first candidate.

Applications for the EDGE Summer Program Are Now Available

The EDGE Foundation is delighted to announce that applications for the EDGE Summer Program are now available! The EDGE Summer Program is a four-week, residential session designed to prepare a cohort of women and gender nonconforming individuals to thrive in their PhD programs in the mathematical sciences. The 2025 EDGE Summer Program will be held June 1–June 28, 2025 at the University of Tennessee, Knoxville.

Program activities include:

- Four core workshops in courses such as algebra, analysis, measure theory, and machine learning.
- Daily collaborative problem sessions with advanced graduate student mentors.
- Regular office hours and highly personalized feedback from facilitators.
- Weekly colloquium on a variety of research topics.
- Special discussions on equity and identity in mathematics, teaching practices, and other professional development skills.

The EDGE Foundation will cover all travel, room, and board expenses related to the Summer Program. Program participants will also receive a modest stipend.

Applicants to the program should be women or gender nonconforming individuals who: 1) are applying to PhD programs in the mathematical sciences or 2) just completed their first year in a PhD program in the mathematical sciences. Students from underrepresented minority groups are especially encouraged to apply.

Apply through MathPrograms at https://www.mathprograms.org/db/programs/1670. Applications are due **February 14, 2025**. For more information, visit https://www.edgeforwomen.org/summer-session/. Please send any questions to edgestaff@edgeforwomen.org.

EDUCATION COLUMN

Education Column Editor: Jackie Dewar, Loyola Marymount Unversity, jdewar@lmu.edu

Befriending the Human in Each Other Through Journaling

By Guadalupe (Guada) Lozano[1]

Journaling in community has become a central piece of the professional development and community of practice spaces I convene or collaborate on.

In general—but especially when we come together to explore how we might teach in inclusive, culturally responsive ways—a heart-centered connection to who we are and what we and our students bring to our classroom can enhance how we relate to each other and change the nature of who we are when we teach. When we are in touch with ourselves authentically, gently, with curiosity, we create fertile space for relational connections—with students, with colleagues, with strangers, with the planet.

Journaling in community is a pathway to bringing not just a part, but our whole selves and others into what we typically consider thought-centered educational or professional experiences—committees, faculty meetings, professional learning spaces, and classrooms.

[1] Research Professor, Mathematics; Director & Endowed Chair, Center for University Education Scholarship, Office of the Provost, The University of Arizona

In this piece, I explore three questions around journaling as a collective practice in academic spaces. What does it look like? What doors does it open? What larger frameworks underpin journaling as a sensing/thinking practice (Rendón, 2023) for those of us who teach, learn or otherwise engage in mathematics with others?

How might journaling in community look?

I wrote the entry in Figure 1 (right) in response to my own community of practice prompt (Figure 1, left), less than a week before writing this column. The setting was the third meeting of the 2024-25 Grounded in Place Professional Development (PD) and Community of Practice (CoP), a group of educators that come together monthly for three hours to explore our culturally affirming precalculus curriculum (Lozano, 2023) and support one another's growth in authentically embracing what it means to teach robust, heart-centered mathematics in relationally grounded and affirming ways.

As I journaled the words in Figure 1—even as convener of our gathering and just after a logistical setback that led us to change rooms minutes before starting—I had a growing sense of new spaces of connection opening, in real time, in front of me. On the one hand, I was connecting with myself just as I was, giving space to my personal 'here and now' through my words on the paper. My colleagues were also immersed in their own spaces of connection: writing effortlessly and without pause on paper or laptops, in the room and behind the zoom screen, with no obligation to share what was being written.

My felt sense—and what I could see around me—suggested people welcomed nourishment in the opportunity to write with ourselves and each other. Nourishment in having (and giving each other) permission to befriend a space that invited our whole

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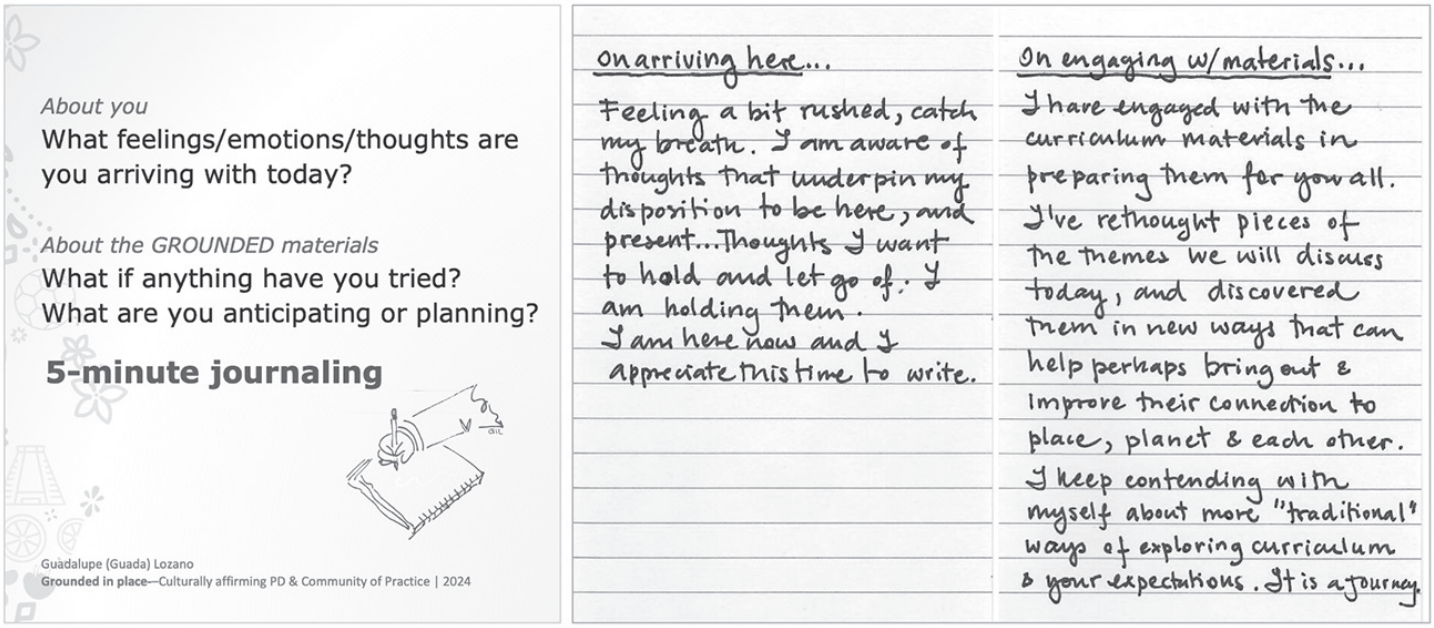

Figure 1. *A journal entry (right) and its prompt (left), written on August 17, 2024, as part of the opening journaling time for the third meeting of the 2024-25 Grounded in Place PD and Community of Practice.*

human selves to be present, not taking away from the time for mathematics, but rather opening room for a different type of mathematics engagement: engagement that is ripe, colorful, alive, vulnerable—fragrant with possibilities for ourselves, our students and the human and other-than-human contexts centered by the culturally affirming precalculus curriculum we had gathered to experience.

Journaling in community can also happen in a conference talk, once or recurrently. The practice needs little time—a 30-second introspection around a simple prompt can happen within a 10-minute talk and bring about an altogether different kind of experience. In a longer talk, or in a classroom lesson, a few opportunities for journaling can be interlaced. What is essential for the practice is to invite it authentically so that trust is established (an honest invitation to write, in a space that protects the moment to do this), boundaries are respected (e.g., no one needs to share and anyone who does is heard and witnessed with heart), and deeper relationality is valued (being with each other or hearing each other is a collective asset). The mathematics hasn't disappeared; it is waiting for us to meet it differently and in presence with each other.

What doors might journaling in community open?

The prompt in Figure 1 led us into an exploration about reciprocity, funds of knowledge, and models of change grounded in the Southwestern U.S. as place. *Reciprocity* is the idea that mathematics, its contexts (for us that day, the Saguaro cactus, the Palo Verde tree and the Sonoran Desert) and ourselves can continually give back to each other. Reciprocity can blossom by kindling our *funds of knowledge*, the late Luis Moll's and colleagues' notion (Moll et al., 1992) that all humans hold priceless experiential, cultural knowledge waiting to be tapped.

That morning, coming back time and again to the idea of reciprocity and tapping into our own funds of knowledge (in anticipation of making space for those of our students), we worked through a mathematical "progression" in our curriculum (Lozano, 2023) where desert Saguaros offer a canvas to discover and explore the concept of function, rate of change, domain and range, and various specific type of functions and behaviors, including piecewise functions, inverse models and concavity.

In opening space for our complete selves to be present as we worked, the initial journaling prompt enabled us to freely draw from our own lived experiences with the contexts of the day's mathematics, enriching the mathematics and each other as we listened and shared authentically throughout our time together.

We learned about particular Saguaros in Arizona, including one shaped like a T-Rex dinosaur—recently in the news—near the Superstition Mountains (thank you Stacie, for the wonderful example). We learned of each other's daily experiences with Palo Verde trees—their blooms and shade, and of other trees dear to some of us, with different growth trends and canopy features. This backdrop to the mathematics enabled a transformed nature to our PD/CoP experience, with honest curiosity for new perspectives and knowledges, where mathematics came alive through its place-based contexts and each other's stories.

Setting the groundwork for authentic connection to the context of the mathematics—for example through journaling in community—can also elicit exquisite funds of knowledge in the classroom. Looking at the graph in Figure 2 (left), alongside three other unitless, unlabeled depictions of models of change (Figure 2, right), one student—hand in the air, wanting to share—was sure about which context this particular graph depicted. As I recall it, they said:

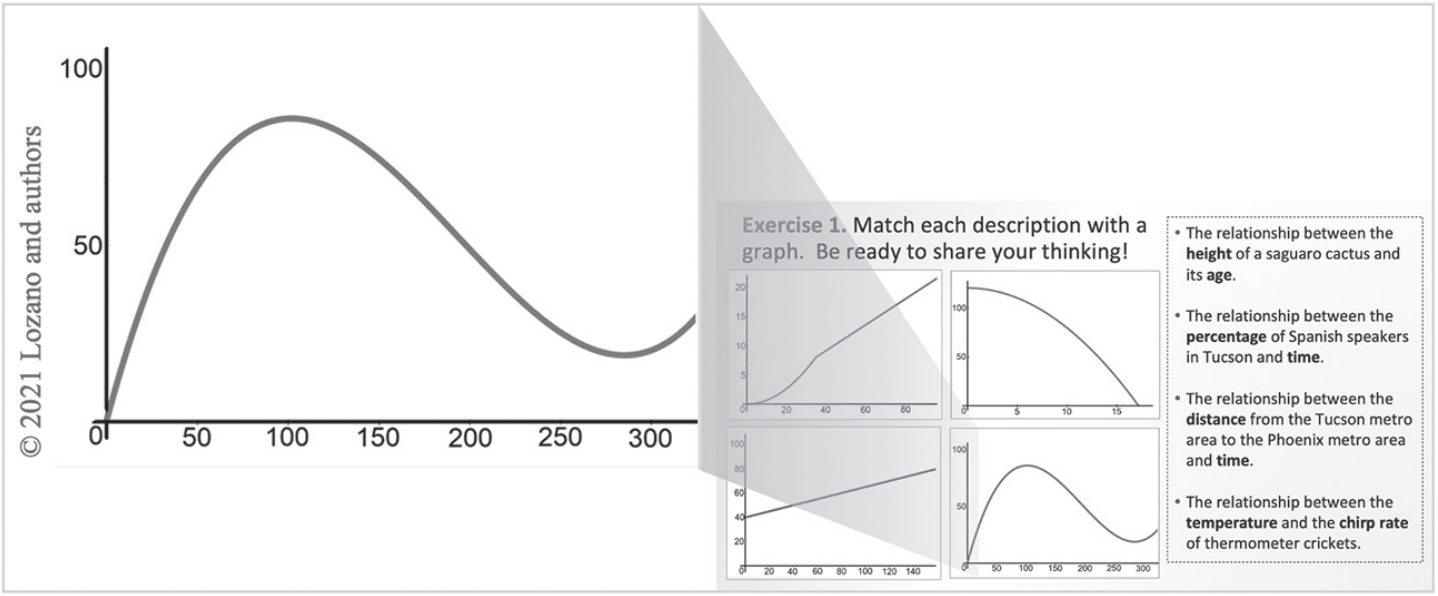

Figure 2. *Graphs of models of change and possible matching stories (right), part of the Grounded in place curriculum (Lozano, 2023) opening lesson. The enlarged polynomial graph (left) models the percentage of Spanish speakers in Southern Arizona. Labels and axis units are deliberately missing.*

> This [graph shows] the percentage of Spanish speakers in our Tucson area. Spanish began to be spoken in the Southwestern U.S. just after [the Spaniards] came to this region. More and more folks spoke Spanish until the U.S. acquired these lands in the Gadsden purchase and English speaking became more and more common. Spanish speaking continued to drop until recent times. Now a new influx of Spanish speakers and renewed interest for the language is reversing the [decreasing] trend.

As this student spoke and their classmates listened, groups of students considered and revised their thoughts about what this particular graph represented. Others added nuance to what had been shared. History, identities and possibly funds of knowledge, eloquently voiced, explained the behavior of an otherwise nameless polynomial graph better and more richly than our data points had led us to model; they illustrated how to read a model of change, how axes values and units can lend nuance to context. Beautifully, the sharing revealed direct connections between mathematics, local history, identity, storytelling and opportunities to grow our relationality through being open to each other's knowledges and experiences.

While not preceded by journaling, this student's account was given space to be told through the same dispositions that make space for journaling. And the story comes up again and again when I—and others who witnessed it—reflect about asset-based pedagogies and the doors they open for ourselves, our students and the mathematics we teach, whose value is still often so elusive.

What pedagogies of care underpin journaling as a sensing/thinking practice?

> *…for listening to the stories of others—*
> *not to their precautions or personal*
> *commandments—is a kind of water that*
> *breaks the fever of our isolation.*
>
> —Mark Nepo, American poet, spiritual adviser, author

Journaling in community is a kind of pedagogy of care that begins with ourselves, and continues—if we so mean it to—into the ecosystems we affect, including our classrooms. As my colleague and friend Judy Marquez-Kiyama shared during a workshop we co-facilitated this summer in Spokane, WA,

> A pedagogy of care emphasizes mutual respect and engenders authentic dialogue that attends to preconceived assumptions, enacts compassion, affirmation, and investment in transformative action (Noddings, 1984) and reciprocal transformation (Nakkula & Ravitch, 1998).

Laura Rendón, in her book *Sentipensante (Sensing/Thinking) Pedagogy* (Rendón, 2023), describes how students' journaling practice can add a contemplative, relational dimension to class assignments that results not only in meaningful completion of a task, but also in a changed relationship with the task itself and its possibilities for us personally, collectively, agentically (Rendón, 2023, pp. 80, 111).

As I have aimed to illustrate in this piece, mathematics happens through who we are, with who we are as we experience it, flourishing through beautiful and sometimes dark human and other-than-human contexts that render it meaningful. Journaling in community is one tool that invites our whole selves and others to share and co-shape a different, reciprocal, life nurturing mathematics experience.

Acknowledgement. Thank you to all of you who come together and give of yourselves, through journaling and other means, to help weave the fabric of meaningful communities like the ones I write about. Keep holding—and letting yourself be held in—nourishing spaces for one another.

References

Lozano, G. I. (2023). Grounded in place: A culturally affirming precalculus curriculum. In M. Strutchens, G. Krause, D. Y. White, & J. Bay-Williams (Eds.), *Antiracist Mathematics Education: Stories of Acknowledgment, Actions, and Accountability* (pp. 7-22). TODOS: Mathematics for ALL.

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into Practice, 31*(2), 132-141. doi.org/10.1080/00405849209543534

Nakkula, M. J., & Ravitch, S. M. (Eds.). (1998). *Matters of Interpretation: Reciprocal Transformation in Therapeutic and Developmental Relationships with Youth*. Jossey-Bass.

Noddings, N. (1984). *Caring, a Feminine Approach to Ethics & Moral Education*. University of California Press.

Rendón, L.I. (2023). *Sentipensante (Sensing / Thinking) Pedagogy: Educating for Wholeness, Social Justice, and Liberation* (2nd ed.). Routledge. doi.org/10.4324/9781003446941

NEW!

THE 2025 *AWM NEWSLETTER* STUDENT COLUMN

Call for Undergraduates and Graduate Students

The AWM Newsletter Editor and Associate Editor are seeking one undergraduate student and one graduate student to bring student voices to the AWM Newsletter in our new Student Column. Are you passionate about broadening conversations around issues of importance to students in the mathematical community? This is a great opportunity for you!

The responsibilities of these two individuals may include:

- Soliciting or writing student pieces and articles for the new Student Column that include and represent diverse perspectives
- Engaging in the mathematical community
- Representing student experiences to the wider mathematical community
- Being aware of what matters to students in the mathematical community

To apply, please submit the following items to Dr. Jenny Fuselier, fuselier@awm-math.org, by **December 5, 2024 at 11:59 pm**.

- A resume or CV
- One-page letter of interest

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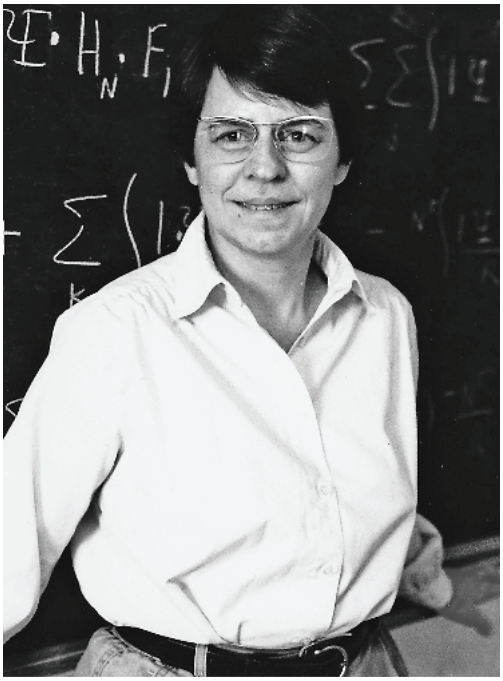
Mary Beth Ruskai, *University of Vermont*, made significant contributions to the AWM. The AWM Committees historical list in the website notes Ruskai's significant contributions, including serving as both a member and chair of the AWM Travel/Mentoring Grant Committee. Ruskai was a 2022 AWM Fellow recognized for championing the cause of women and girls in science through AWM. She was also recognized for serving as a voice of reason and a call for change through articles and discussions that illuminate the challenges facing women in mathematics and science.

In Memory of Mary Beth Ruskai



By Elisabeth Werner

Mary Beth Ruskai passed away at her home in Vermont on September 27, 2023. Born in Cleveland, Ohio, in 1944, she earned degrees in chemistry, mathematics, and physical chemistry. She worked in mathematics and mathematical physics and was a Fellow of the American Mathematical Society, the Association for Women in Mathematics, the American Physical Society, and the American Association for the Advancement of Science. Beth spoke up whenever she saw injustice, and her work in this area included both analysis and advocacy. She was also an avid outdoors woman and chose her retirement home in Vermont for its access to hiking and cross-country skiing.

Remembrances[1] from collaborators, colleagues, and friends will describe many of Beth's research contributions. Beth gave her own summary (on a personal web page no longer available). She included her celebrated work with Lieb proving the strong subadditivity of quantum entropy (SSA) and her proof of what Barry Simon named the Ruskai-Sigal Theorem.[2] She also described her move into quantum information theory, where the SSA theorem on quantum entropy plays an important role. Those of us who knew her can hear her voice in the conclusion of her summary:

> I worked with a group of young people at MIT who showed that quantum error correcting codes could be used to solve a question about *N*-representability that had been open for almost 40 years. In 2012, on the 40th anniversary of the proof of SSA, Isaac Kim (then a graduate student at Caltech) proved a stronger version of SSA, which I did not believe was possible....
>
> As I near the end of my research career, I feel that in many ways I have come full circle. I enjoy meeting and working with young people who have new insights which enable them to move forward and prove stronger theorems.

I first met Mary Beth when she was the Flora Stone Mather Visiting Professor at Case Western Reserve University in 1995. I was then an assistant professor at Case. Mary Beth taught a course on Wavelets and I took it. Mary Beth delivered her lectures, as was always the case with her, enthusiastically and with much gusto. I was thrilled.

My next meeting with Mary Beth was at the Georgia Institute of Technology. I was giving a talk on geometric inequalities, based on joint work with my colleague from Case Western, Stanislaw Szarek[19]. Mary Beth was in the audience and she approached me after the talk, as she noticed that some of these inequalities, or refinements thereof, might be relevant for her work on one-dimensional analogs of the Coulomb potential for atoms in strong magnetic fields. We started to discuss and this led to many mutual visits in Cleveland and Boston and eventually to our earliest joint publications, one of which is also joint with R. Brummelhuis [2][16].

When I next heard from Mary Beth, she had started to work in quantum information theory. She later told me how much she enjoyed doing research in this particular area and that it had rekindled her joy in doing research. Relevant objects in quantum information theory are quantum channels. Important examples of quantum channels are completely positive trace preserving maps Φ on M_n, the algebra of complex n x n matrices. These form convex sets. To get a better understanding of the quantum objects, it was important to characterize the boundary structure of these sets,

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and, for instance, identify the extreme points of these sets. If we know the extreme points, we can reconstruct the whole set. That was exactly the question Mary Beth asked Stanislaw Szarek and me to work on with her.

And then the fun started: the "battle" between Mary Beth and Stanislaw—and me in between! Stanislaw and I had a pretty good idea of how to approach this problem. But when we presented it to Mary Beth she vehemently objected, stating that this was not at all what was needed, but something completely different and we missed the point entirely. It was useless to convince her otherwise—which will not surprise anybody who knew Mary Beth. Discussions and email exchanges got rather heated—the more so as my colleague Stanislaw also enjoys a lively discussion, occasionally deliberately putting oil in the fire. Back and forth things went over weeks and months—but in the end, all was good and we had a very nice paper **[15**. We found a useful new "arithmetic" characterization of the set of all completely positive, trace-preserving maps $\phi : M_2 \rightarrow M_2$ and described explicitly all extreme points of this set.

Mary Beth and I wrote one more joint paper **[17]**. Mutual visits continued, in Boston, Cleveland, and in Kiel, Germany. We both enjoyed having dinners at nice restaurants. Mary Beth liked outdoor activities, such as cross-country skiing and hiking. On one of our many walks together, in the Flats of Cleveland, she told me about growing up in the Hungarian community of Cleveland. She was interested in Science and Mathematics but in those days it was even more difficult for women to succeed there. Of course, Mary Beth prevailed.

Mary Beth was a force to be reckoned with. She was passionate about the issues she cared about. Among them was her engagement in promoting women in Science and Mathematics. She has made a difference and her legacy will stay.

Elisabeth Werner is a professor of mathematics at Case Western Reserve University. Her email address is emw2@case.edu.

By Michael Aizenman

Mary Beth Ruskai, or "Beth"—as she signed correspondence, was a notable mathematical physicist with interests in topics related to the quantum nature of physics. She was also a thoughtful colleague who did not hesitate to share her views on a range of subjects related to the way our profession has been evolving.

Mathematical physicists are a rare breed, straddling two fields which despite their obvious intertwining have different goals, tools, and criteria by which success is evaluated. Having a cross-disciplinary grasp is rare. Beth had it.

In research, she made her mark in two distinct areas of quantum physics. Particularly consequential was her work with Elliott Lieb on the strong subadditivity of quantum entropy (SSA) **[6]**. Entropy is a subtle concept, originally introduced in thermodynamics as a quantifier of the irreversibility of realizable processes. Among its practical applications are bounds on the efficiency of possible energy transfers. The initially elusive intrinsic meaning of entropy was explained in a breakthrough contribution of Boltz-mann along with his introduction of statistical mechanics. From that, in a creative leap, C. Shannon introduced an analogous concept of entropy as a measure of information, which allows quantification of communication channel capacity.

As Beth was starting her research career she was exposed to the discussions among mathematical physicists (D. Robinson, H. Araki, D. Ruelle, O. Lanford, E. Lieb) who were grappling with the fundamentals of quantum statistical mechanics. A simply stated extension of the Gibbs formula for the entropy of a quantum state was presented earlier by John von Neumann. It clearly shared some of the significant properties of the classical Gibbs state entropy function, but not all. There are many structural similarities between the theoretical formulations of classical and quantum physics, but famously there are also some striking differences between the two theories.

Still, quantum entropy shares its classical version's subadditivity $S(AB) \leq S(A)+S(B)+S(BC)$. Does it also share the classical entropy's strong subadditivity $S(AB) + S(A)+S(B) \leq S(BC)$? The answer is Yes—but it took quite some effort to establish that. The proof was presented in the celebrated 1973 joint paper with Elliott Lieb. Further details and historical recollections on this work can be found in the authors' contributions to the recent AMS memorial article on D. Robinson **[1]**.

Their result is of lasting relevance. Initially it was appreciated for its significance for quantum statistical mechanics. With time it gained additional recognition within the emerging field of quantum information theory. Thirty years after its proof, SSA was referred to as the stepping-stone to a significant part of the theory of quantum entanglement **[7]**. As we are now aware, von Neumann's quantum entropy combines elements of Boltzmann/Gibbs statistical physics, with a quantum extension of Shannon's notions of information theory. The differences from the classical theory can be traced to the phenomenon of quantum entanglement between A and B.

In another direction, Beth's early work included theorems regarding large atoms with Coulomb interaction, that placed upper bounds on the excess negative charge which large ions can support (see **[14]**).

Over the following years, Beth continued to produce results which deepened our grasp of topics in quantum statistical mechanics and quantum information theory (some of which are mentioned in the contribution to this memoir by Elisabeth Werner). She also continued to express interest in streamlined and more transparent derivations of SSA, and in its different extensions (**[11]**).

During my service as its editor-in-chief, I invited Beth to join the editorial board of *Communications in Mathematical Physics* and serve as the editor of a new section on quantum information theory. In that role, which lasted through 2012, she was proactive, dedicated, and effective, and developed QIT's presence in this flagship journal of its field.

Although most of the time we worked on different research

topics, Beth and I sporadically had the chance to meet, update each other on our research, and enjoy friendly discussions. Beth tended to be opinionated, but she would also listen and take into account the feedback she got. We always found common ground, shared perspective, and reasons to laugh.

Beth's career was launched at the time when being female could be a handicap in the world of mathematics and science. Seeking a suitable research environment, and not being one to yield to adversity, she complemented her regular university service with visiting appointments at a range of research institutes and universities, including Rockefeller, Courant, Bunting/Radcliffe Institutes, Vienna University, TU-Berlin, Dublin Institute of Technology, Georgia Tech, and Case Western Reserve.

Beth contributed to ongoing discussions concerning the underrepresentation of women in STEM departments. She called attention to the problem citing statistics, relevant research, and the occasional manifestations of harmful atmosphere **[10]**:

> In my experience, few scientists are overtly sexist and many have been extremely supportive toward women. But very few are willing to deal with sexism when they should, which gives a small number of "bad guys" disproportionate influence, particularly with junior women at critical phases in their careers.

She also contributed to the exchanges on ways to increase women's presence in science. There, she was critical of presentations which take for granted the existence of gender-linked differences in skills in computer science, and more broadly mathematics and science, writing in the *Newsletter* of the Association for Women in Mathematics (1986, 5-6):

> One recurrent idea in many articles of this type is that women are more intuitive than men, where intuition and logic are perceived of as opposites. In this context the notion that women are more intuitive seems suspiciously like a rewording of the old bigoted male accusation that women can't think logically.

Addressing some of the circulating ideas on potential contrast between art and creative endeavors versus math and science she wrote there:

> Many of my non-science [women] colleagues at Bunting were surprised to learn that scientists consider themselves creative and artistic; they were amazed that I used words like beautiful and elegant to describe theorems and proofs. I fear that such misunderstandings promote negative attitudes toward science which discourage young women from scientific careers.

Our correspondence was renewed in 2022, close to the 50th anniversary of the early SSA work. Beth's continuing engagement with aspects of SSA has indirectly contributed motivation for my recent work with Giorgio Cipolloni, which presents an alternative path to the proof. The paper, dedicated to Lieb and Ruskai in celebration of their joint work, formed our submission to the special issue of *Letters in Mathematical Physics* dedicated to Beth **[5]**.

The last time I heard from Beth was in June 2023, in a message sent in reply to the slides of my talk on the above work at Joel Lebowitz's 124th Statistical Mechanics Conference (Rutgers, May 2023). She recalled attending some of the early meetings of this remarkable series in the mid-1970s, in its old venue—the Belfer Graduate School of Yeshiva University. That must have been where our paths crossed first.

Now, writing that she was switching to palliative care, Beth added, "For the past 5 years I was stable on a treatment with minimal side effects and could enjoy easy hiking, XC skiing and gardening. I was also able to finish 3 math papers which I feel good about." These few lines, written at a sad moment, epitomize for me Beth's character and courage.

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By Ingrid Daubechies

Mary Beth Ruskai and I met for the first time on Monday June 2, 1980. The date is engraved so precisely in my mind because it was the start of a summer school on Rigorous Results for Scattering Theory in Quantum Mechanics at the Ettore Majorana Center in Erice, Sicily, to which I traveled just two days after the oral defense of my PhD thesis. Although it was over 40 years ago, the memories of that summer school are vivid.

Beth took me under her wing almost immediately. There were not many women in mathematical physics then, and as the new kid on the quantum mechanics block, I felt rather shy. She introduced herself to me, and then looked out for me all through the summer school. She made sure that I met all the other young students and postdocs who were there, and that I did not slink off for lunch in a corner because I didn't know anyone yet. She introduced me to the more senior researchers, and in particular to Elliott Lieb, with whom she had worked on quantum mechanical entropy. It was as a direct consequence of this introduction, and Lieb's subsequent interest in some coherent state estimates in my thesis, that I arrived in Princeton in the Spring of 1981 for postdoctoral work with Lieb. I was grateful then, and have been ever since—that summer school was a luminous experience for me, in great part due to Beth's persistent efforts on my behalf.

I also learned about other aspects of Beth. As was not uncommon at the Ettore Majorana Center, two summer schools on entirely different topics were being held concurrently. The participants in the summer schools interacted sporadically, by

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having evening social events in adjacent areas, and were curious about each other. The directors of the two summer schools planned to each give a general lecture on successive evenings, to introduce the other community to what was going on in their own. The other summer school was centered on what was then called "genetic manipulation." Recombination of DNA had started less than ten years before, and the first US FDA approval of a genetically modified organism wouldn't happen until 1982.

Almost all of the mathematical physics participants in our summer school attended the biological evening lecture, which was riveting and gave rise to a lively discussion afterward, notably about the potential dangers of genetic engineering and the need for ethical guidelines. The next evening it was Arthur Wightman's turn; he tried, without using many equations, to give a very precise description of some of the central issues in our summer school. There had been a lot of speculation that one of the several participating experts working on asymptotic completeness (not yet proved at the time) would announce a big result in one of his lectures. This did not happen. (Full proofs were published only in 1987 **[18]** and 1994 **[4]**.) Maybe Wightman thought to captivate his audience by the drama of a fervently anticipated result that then didn't materialize? His attempt to explain the rather technical problem of asymptotic completeness fell flat.

There were no questions from the biologists, during or after the lecture. After a few awkward moments of silence, the director of the biology summer school stood up and commented that the night before, there had been a lot of discussion of the possible dangers of their field of research, but it had also been clear that there was a lot of excitement. In contrast, he felt that the questions preoccupying us were less likely to lead to dangerous outcomes; he hoped we would not be offended if they seemed also less exciting, at least to him.

Many of the younger participants in the Quantum Mechanics summer school attended Wightman's lecture, curious to hear how he would present mathematical physics to biologists. I was sitting next to Beth in the audience, and I remember her indignation when she realized that Wightman had chosen to construct his presentation with a narrow focus rather than standing up as the advocate for mathematical physics more generally. She seethed (rather quietly, by Beth's standards, because she had a lot of respect for Wightman) for two days before joining the rest of us in laughing about the episode.

After I arrived in the US, a year later, Beth invited me several times to come visit her in Boston. She delighted in making me discover new places, new sights, new aspects of life in the US—I had never been out of Europe before. One memorable day in the Fall we drove up to New Hampshire, to climb Mount Washington. We had left very early and were already well on our way when the sun rose. In the red-tinted light of the dawn, one vividly colored tree on the dividing berm in the middle of the highway seemed to be on fire. I was only half convinced by Beth's assurances that it was just a combination of the light and the spectacular Fall colors for which New England is renowned; on our way back to Boston that evening, Beth drew my attention to the same tree, which indeed had not burned down. The hike itself was truly memorable: as we walked up, we transitioned from a vale with trees just starting to turn, to the flamboyancy of a New England forest in peak fall color, to wintry trees that had lost all their leaves, and finally to the denuded top, above the treeline, where strong icy winds had turned freezing rain into virtually horizontal icicles, now glistening in the sun. Over time, Beth and I went on other hikes, in different parts of the world—Beth was a great enthusiast for the outdoors—but that first one stood out in both our memories.

In later years, our paths intersected many times, at conferences in which we both participated, or when one of us invited the other. We always reconnected easily, even if sometimes years had passed. Between meetings, Beth would sometimes draw my attention to issues that she knew would interest me and on which she was speaking out. For instance, at some point in the 90s, she alerted me to arguments from female social scientists who sought to explain the low percentage of women in mathematics by the nature of mathematical thinking itself, antithetical, according to their views, to the more intuitive, nurturing nature of women—I had missed that debate and joined Beth in expressing complete disagreement with that "take" on mathematics. She also introduced me to Rhonda Hughes who, with Sylvia Bozeman, started the EDGE (Enhancing Diversity in Graduate Education) program, which sought (and seeks!) to better prepare women students seeking a PhD in the mathematical sciences for grad school. I have been proud ever since to be affiliated with the EDGE program. Near the end of her life, Beth made a significant financial gift to EDGE. I am sorry that she missed the October 2023 25th anniversary of EDGE, a joyful mathematics and community celebration where her memory was honored. EDGE has established the Mary Beth Ruskai Research Fund for Women.

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By Mary Gray

Others write of Beth's distinguished contributions in a variety of areas of the mathematical sciences, her warmth of friendship, her devotion to causes in which she believed. If I were to choose a single word to describe Beth, it would be persistence. Persistence, yes, in her broad field of research, consistently following up on notable results. But for me most memorable was her devotion to the use of documentation to promote the as-yet-unresolved long battle for the improvement of the position of women in the mathematical sciences.

Beth, like many of us, applauded the increase of women among PhD's in mathematics from a low of less than 10% to

consistent representation in the mid-twenties, while noting a regrettable lack not only of something more but of the uneven distribution of gains that had occurred. Beth would have been disappointed that a recent issue of the American Mathematical Society newsletter citing eight winners of major prizes in mathematics included only one woman. To those who rightly and enthusiastically cheered the recognition of a handful of women mathematicians at top universities and Fields and other medalists, Beth pointed out that data also showed the continued lack of progress at institutions, perhaps second tier, where many women were consistently overlooked or under valued, although perhaps not so much in hiring, as at the crucial steps of advancement to tenure, full professor, department chair, or holder of a named chair. Reporting on the latest overall results for women in math, Beth would have remarked that we still have far to go in achieving equality and that we should do something about it. How could we all give up while Beth was still reminding us. Her efforts to document the progress—or lack of it—of women researchers has provided a sound basis for the need for continued and increased effort on behalf of women in mathematics.

Indeed, many of us relied upon Beth's regularly compiled statistics to urge more success, often unaware of her effort in compiling results of degrees, hiring, and recognition through appointments and awards. Looking at the numbers, we see the AMS's long delayed recent election of three women as president, although it took 95 years from its founding to elect the first some 36 years ago, or the association's more-than-a-quarter-century effort to adopt a blind refereeing policy as a waypoint in, not the culmination of, a campaign. These are just a few among the results of the persistent advocacy of Beth and others.

Another, perhaps less-recognized, manifestation of Beth's persistence was her constant battle against governmental intrusion on our civil rights, in particular through the formulation and over-enthusiastic implementation of TSA airport searches. From an arrest—as a lawyer I was the recipient of "Do you know a good lawyer in Boston?"—to the courts, her persistence was part of the effort to make getting on a plane less traumatic.

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By Cathy Kessel

I first encountered Beth Ruskai through her articles in the *Newsletter* of the Association for Women in Mathematics,[3] beginning with her 1986 "Open Letter on Feminism in Science." Her two years at the Bunting Institute (now the Radcliffe Institute of Advanced Study) had convinced her that there was cause for concern about the negative and inaccurate views of science and women scientists promulgated by a "vocal minority" of non-scientist women "in so-called feminist circles" as well as the popular press. (Here "science" and "scientist" refer to natural rather than social sciences.)

The idea that science could be a creative and artistic endeavor surprised her Bunting colleagues. Many had heard that scientific fields used "numbers as their whole means of discovery," "women are not interested in science—because it doesn't deal with subtleties," "women are more intuitive than men, where intuition and logic are perceived of as opposites," "women are naturally more inclined to the biological sciences because of their 'nurturing' instincts," and science "must change in fundamental ways in order to accommodate women."
Beth wrote:

> That non-scientists do regard the views of this vocal minority as orthodox was impressed upon me during my stay at the Bunting Institute. Most of the women I met at Bunting ordinarily had little or no contact with women scientists, whom they assume to be far rarer and more isolated than we actually are. (One seemed surprised to learn that I actually knew other women mathematicians.) Their attitudes toward science ranged from enthusiastic amateur to severe anxiety and avoidance. But most of them, regardless of attitude, received their information about women scientists from [social scientists], some of whom they regarded as scientists.... As a result, their views about science and women scientists were often quite distorted. Furthermore, because the social scientists in question are widely regarded as staunch feminists, dissenting views are sometimes regarded as non-feminist.

The Open Letter received many responses, both in the *Newsletter* of the AWM, and in the *Gazette* of the Committee on the Status of Women in Physics (CSWP),[4] where it had also been published. These were followed by talks and panels at meetings, including two at the American Association for the Advancement of Science annual meeting—one sponsored by AWM and one sponsored by CSWP—and a study conference on gender and mathematics education organized by the International Commission on Mathematical Instruction. These resulted in articles for a more general scientific audience in *The Scientist* **[13]** and *Annals of the New York Academy of Sciences* **[12]**.

A second focus of Beth's writings on gender, women, and science was mathematical ability. Looking back, it seems to me that Beth was one of very few in the natural sciences to write on this topic in a systematic, scholarly, and scientific way. Her 1991 article "Are There Innate Cognitive Gender Differences? Some Comments on the Evidence in Response to a Letter from M. Levin" was published in the *American Journal of Physics*, and reprinted in the CSWP *Gazette* and the Physics Teachers CD-ROM Toolkit distributed by the American Association of Physics Teachers.

In 2005, Harvard president Lawrence Summers's conjectures about women in science, first mentioned in the *Boston*

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Globe, spread nationally, then internationally. A group of AWM members began discussing how to respond. Beth quickly produced an op-ed which she submitted to the *Globe*.[5] It began:

> I had hoped that I could resist the urge to comment on Harvard President Larry Summers' remarks about women; however, none of the responses I've read adequately addressed one question...was it legitimate to call for research on the question of whether women have less innate mathematical ability?
>
> As a scientist, I've learned that progress requires the acceptance of well-verified theories as well as the willingness to consider new hypotheses for unexplained phenomena. Engineers trying to design better cooling systems do not waste time with proposals that violate the second law of thermodynamics. In 1986, the British Royal Society (hardly a bastion of radical feminist theory) concluded that there was no convincing evidence for innate gender differences in mathematical ability. Does Summers have new evidence that would call for reopening this question?

Prominent among the studies discussed in connection with the Summers remarks were the widely publicized gender-gap findings of Camilla Benbow and her colleagues from the early 1980s. Beth pointed out in 1991 that Benbow had not mentioned subsequent findings showing smaller gaps during the intervening years, instead asserting that the gap had remained relatively constant. Although other researchers had noted changes since the 1980s, their articles received little notice. The 1980s findings continued to be cited in scholarly and popular books.

In 2006, Benbow was appointed as a member of the National Mathematics Advisory Panel, which was intended to "foster greater knowledge of and improved performance in mathematics among American students." AWM petitioned for her removal. (I was AWM president-elect at the time.) As in the case of the Summers remarks, I (and AWM) benefited from Beth's comments about what and how to communicate to other organizations, reporters, and a general audience.

One example of her wonderful humor and clear eye for what was important comes from an after-dinner talk in honor of the mathematical physicist Barry Simon.[6]

> I want to talk to you tonight about a side that some of you may not be so familiar with—Barry Simon, the radical feminist...[laughter, Beth smiles]
>
> Barry is incredibly meticulous about references. His books have extensive historical notes and they have, as many people have said, influenced the subject. They have not only influenced the subject, but they've influenced people's careers.
>
> I particularly want to mention the work of Clasine van Winter whose work might have been completely forgotten had it not been for Barry, and also the book by Reed and Simon, naming the HVZ theorem, making sure everyone's contributions to this theorem were recognized. I was shocked a year or two ago to meet a particle physicist who referred to the Weinberg equations of scattering theory when we all know that they're the Weinberg–Van Winter equations. Periodically I have these conversations with people, they say, Well, why do people worry about whether there are women speakers on the program or whether there are women mathematicians or physicists on the faculty? Why can't we just forget about affirmative action and do everything gender-blind, on the basis of merit? Of course, this is what we all want. But first we need more people like Barry Simon.

…and Mary Beth Ruskai.

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By Harriet Pollatsek

In 1998–1999, when I was first learning about error correction in quantum computing while on sabbatical in England, I was electronically introduced to Beth by our mutual friend Barbara Peskin. Even though I was effectively a novice (the intersection of my mathematical expertise and Beth's was just barely non-empty), Beth warmly welcomed me as a colleague. When I returned to Massachusetts, we began meeting regularly. I couldn't have had a more generous guide to this area of mathematics nor a more enthusiastic teacher. The main result of our collaboration was our joint paper **[9]**, in which we obtained a number of new (non-additive) binary codes for quantum error correction and showed that the degeneracy arising from permutational symmetry facilitates the correction of certain two-bit errors.

Around the time Beth and I were first introduced, Roger Horn, then editor of the *American Mathematical Monthly*, invited Beth to write something for the Monthly about quantum computing and error correction. Beth didn't really have time to do it herself, but she thought it would be possible if we did it jointly. I agreed, and our plan was that I would do first drafts of sections and she would comment. When I sent her my first attempt, the comments came back ALL IN CAPS. Second try, more CAPS, including exclamation marks. Third try, the same. So I wrote back to say that doing it jointly clearly wasn't a good idea, and I should bow out. NO NO she replied; I should do it myself and she would help, and I could thank her fulsomely in my acknowledgments. And so it[7] came to pass.

Our mathematical collaboration eventually ended, but Beth and I remained in touch, visiting each other regularly—electronically after she moved to Vermont. Not only was Beth a superb mathematician and a stalwart defender of what she knew to be right, she was a generous colleague and a wonderful friend. I miss her.

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By Graeme Smith

I first met Mary Beth Ruskai while I was a graduate student at Caltech getting started in quantum information theory, probably around 2005. I was getting interested in questions about the additivity (and non-additivity) of entropy formulas that show up in information theory, and Beth had done some of the most interesting work in this area. In the following years, I had the good fortune to become her collaborator and we had many valuable discussions about quantum information. It was always a treat to see her at a conference and catch up on her thinking about (non) additivity, about which she invariably had interesting new ideas.

Of course Beth's most famous work was proving strong subadditivity, but to me she was a guru of additivity. She made key contributions to the theory of additivity in quantum information, especially additivity of the Holevo information and related questions.

When Holevo information is additive, we can evaluate the capacity of a quantum channel for classical communication effectively. For many years it was conjectured that Holevo information was *always* additive. Beth played a key role in identifying this question as a central challenge for quantum information, proving additivity for special cases of channels, and formulating a simpler (a priori weaker) version of the question in the form of the minimum output entropy conjecture. She was also a kind of evangelist, looking to get others interested in the problem and patiently explaining the ins and outs of the question to graduate students and distinguished colleagues alike.

While it turns out that in general both the additivity of Holevo information and minimum output entropy have counterexamples, Beth's proofs of additivity for specific channels as well as her reformulations of the question are essential to our understanding of the classical capacity of a quantum channel.

In addition to her technical contributions, Beth organized conferences, special sessions, and workshops regularly. These events helped many of us build new collaborations, meet new people, and learn about science outside our immediate areas of expertise. In particular, she was instrumental in forging connections among quantum information theorists, mathematical physicists, and operator theorists. This involved convincing quantum information folks that the mathematicians had really useful techniques and ideas that would help us solve problems we care about, and convincing the mathematicians that the information theorists had substantial questions worth tackling (and we were reasonably capable of rigorous mathematics). Over the years, Beth worked to bring quantum information theorists and mathematicians together. Both communities have benefited tremendously from her efforts.

We miss you Beth!

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By Bei Zeng

I had the honor of meeting Beth Ruskai during my PhD journey at MIT around 2008. She was a familiar presence at MIT, engaging in insightful discussions with luminaries like Peter Shor and others from the quantum information groups. Our initial conversations, centered around Hastings's groundbreaking results on the superadditivity of communication capacity, marked the start of a deeply educational and inspiring journey with Beth.

Beth's extensive knowledge led us into the intricate world of *N*-representability," a field intrinsically linked to her own doctoral research. This intellectual exploration was not only a profound learning experience but also led to our joint work, "Quantum Codes Give Counterexamples to the Unique Preimage Conjecture of the *N*-Representability Problem." **[8]**.

In 2009, my career transitioned to the Institute for Quantum Computing (IQC) at the University of Waterloo / University of Guelph. In a fortunate parallel, Beth became an associate member of IQC, which meant our paths continued to cross regularly. We delved further into *N*-representability, a topic that was attracting considerable attention in the quantum information community due to its relation to the "quantum marginal problem." This collaboration led to another joint publication, "Comment on some results of Erdahl and the convex structure of reduced density matrices." **[3]**.

As Beth prepared for her move from Boston to a retirement community in Vermont, she generously shared with me a treasure trove of her old materials, including her 1969 thesis and proceedings from the *N*-representability conferences held at Queen's University around 1968–1969. These resources were not just a glimpse into the past but also a catalyst for future endeavors. Heeding Beth's suggestion, we embarked on organizing workshops centered on the "quantum marginal problem." In the summer of 2015, we realized this vision by hosting a workshop on "Quantum Marginals and Numerical Ranges" at the University of Guelph. This event was a collaborative effort, organized by a team of colleagues including David Kribs, Paul W. Ayers (a chemist from McMaster and a long-time friend of Beth's), Isaac Kim, and myself. The success of this conference stood as a testament to Beth's enduring influence and her unwavering commitment to advancing the frontiers of knowledge.

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Working with Beth was an experience that went beyond intellectual enrichment; it was a source of personal inspiration. Her exceptional ability to inspire the younger generation made her a remarkable mentor and collaborator. Beth's legacy in the quantum information field and her impact on all those she mentored and collaborated with will undoubtedly resonate for many years to come.

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Concluding remarks

From Beth's sister Lois Melina:

At one point during her final days, Beth tried to explain quantum theory to her hospice nurse and social worker. Her eyes lit up. Her voice was strong. She was animated. Clearly, she was in her happy place.

Acknowledgment

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References

[1] Michael Barnsley, Bruno Nachtergaele, and Barry Simon, *Remembrances of Derek William Robinson, June 25, 1935–August 31, 2021*, Notices Amer. Math. Soc. 70 (2023), no. 8, 1252–1267, DOI 10.1090/noti2765. With contributions. MR4626738, Show rawAMSref

[2] Raymond Brummelhuis, Mary Beth Ruskai, and Elisabeth Werner, *One-dimensional regularizations of the Coulomb potential with application to atoms in strong magnetic fields*, Differential equations and mathematical physics (Birmingham, AL, 1999), AMS/IP Stud. Adv. Math., vol. 16, Amer. Math. Soc., Providence, RI, 2000, pp. 67–75, DOI 10.1090/amsip/016/07. MR1764742, Show rawAMSref

[3] Jianxin Chen, Zhengfeng Ji, Mary Beth Ruskai, Bei Zeng, and Duan-Lu Zhou, *Comment on some results of Erdahl and the convex structure of reduced density matrices*, J. Math. Phys. 53 (2012), no. 7, 072203, 11, DOI 10.1063/1.4736842. MR2985219, Show rawAMSref

[4] Jan Dereziński, *Asymptotic completeness of long-range N-body quantum systems*, Ann. of Math. (2) 138 (1993), no. 2, 427–476, DOI 10.2307/2946615. MR1240577, Show rawAMSref

[5] Letters in Mathematical Physics, Special Issue Honoring Mary Beth Ruskai (2023, 2024) ISSN 1573-0530 (online) https://link.springer.com/journal/11005/topicalCollection/AC_ec56e63fb7775d3da0cd137ae6cb2cbe

[6] Elliott H. Lieb and Mary Beth Ruskai, *A fundamental property of quantum-mechanical entropy*, Phys. Rev. Lett. 30 (1973), 434–436, DOI 10.1103/PhysRevLett.30.434. MR373508, Show rawAMSref

[7] Noah Linden and Andreas Winter, *A new inequality for the von Neumann entropy*, Comm. Math. Phys. 259 (2005), no. 1, 129–138, DOI 10.1007/s00220-005-1361-2. MR2169971, Show rawAMSref

[8] S.A. Ocko, X. Chen, B. Zeng, B. Yoshida, Z. Ji, M.B. Ruskai, I.L. Chuang, *Quantum codes give counterexamples to the unique preimage conjecture of the N-representability problem*, Physical Review Letters 106 (2011), 110501.

[9] Harriet Pollatsek and Mary Beth Ruskai, *Permutationally invariant codes for quantum error correction*, Linear Algebra Appl. 392 (2004), 255–288, DOI 10.1016/j.laa.2004.06.014. MR2095917, Show rawAMSref

[10] M. B. Ruskai, *A Few Bad Guys in the Lab Can Cause Women a Lot of Harm*, New York Times. 2015-06-12.

[11] M. B. Ruskai, *Evolution of a Fundamental Theorem on Quantum Entropy, Conference in honor of the 90th Birthday of Freeman Dyson*, (IAS NTU, Singapore Aug. 2013).

[12] Mary Beth Ruskai, *Are "feminist perspectives" in mathematics and science feminist?*, The flight from science and reason (New York, 1995), Ann. New York Acad. Sci., vol. 775, New York Acad. Sci., New York, 1996, pp. 437–441, DOI 10.1111/j.1749-6632.1996.tb23159.x. MR1607506, Show rawAMSref

[13] M. B. Ruskai, *Why Women are Discouraged from Becoming Scientists*, The Scientist 4 (1990), 17–19.

[14] Mary Beth Ruskai, *Limit on the excess negative charge of a dynamic diatomic molecule* (English, with French summary), Ann. Inst. H. Poincaré Phys. Théor. 52 (1990), no. 4, 397–414. MR1062906, Show rawAMSref

[15] Mary Beth Ruskai, Stanislaw Szarek, and Elisabeth Werner, *An analysis of completely positive trace-preserving maps on M_2*, Linear Algebra Appl. 347 (2002), 159–187, DOI 10.1016/S0024-3795(01)00547-X. MR1899888, Show rawAMSref

[16] Mary Beth Ruskai and Elisabeth Werner, *Study of a class of regularizations of* $1/|X|$ *using Gaussian integrals*, SIAM J. Math. Anal. 32 (2000), no. 2, 435–463, DOI 10.1137/S0036141099353758. MR1781466, Show rawAMSref

[17] Mary Beth Ruskai and Elisabeth M. Werner, *Bipartite states of low rank are almost surely entangled*, J. Phys. A 42 (2009), no. 9, 095303, 15, DOI 10.1088/1751-8113/42/9/095303. MR2525543, Show rawAMSref

[18] I. M. Sigal and A. Soffer, *The N-particle scattering problem: asymptotic completeness for short-range systems*, Ann. of Math. (2) 126 (1987), no. 1, 35–108, DOI 10.2307/1971345. MR898052, Show rawAMSref

[19] Stanisław J. Szarek and Elisabeth Werner, *A nonsymmetric correlation inequality for Gaussian measure*, J. Multivariate Anal. 68 (1999), no. 2, 193–211, DOI 10.1006/jmva.1998.1784. MR1677442, Show rawAMSref

Article DOI: 10.1090/noti3048

Mary Beth Ruskai, ca. 2010.

Mary Beth Ruskai giving an after-dinner talk in honor of Barry Simon.

Left to right: Richard Dudley, Mary Beth Ruskai, Alice Silverberg, Barbara Lee Keyfitz, AWM panel on Lawrence H. Summers at JMM 2006.

Mary Beth Ruskai on left with Barry Simon and his coauthors, 2006; 60th birthday fest for Barry Simon.

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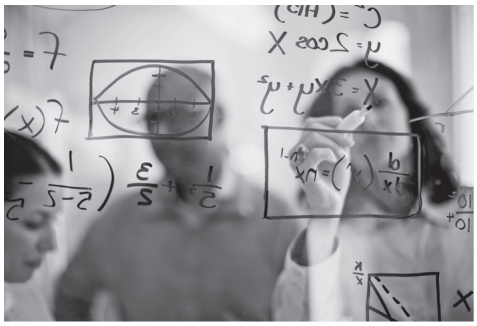

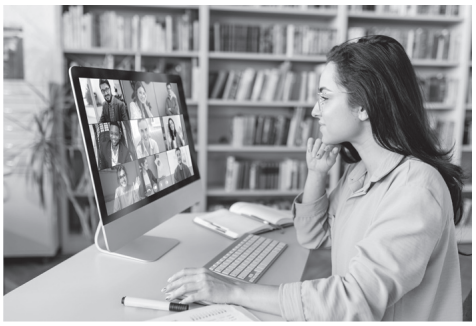

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