Mathematical Association of America

North Central Section

Spring Meeting • March 24-25, 2023
Winona State University
Winona, Minnesota

WINONA STATE UNIVERSITY

	Friday, March 24, 2023 (6:00pm – 10:00pm)
6:00 – 8:30	**Registration** Science Learning Center (SLC) Atrium $25/Free for Invited Speakers, Students, Retired, VITAL Faculty and HS Educators
6:30 – 7:00	**Welcome and Announcements** **Welcome by Dr. Scott R. Olsen, President, Winona State University** Stark 103 Aaron Wangberg, MAA-NCS President
7:00 – 7:50	**Estimation Game** Stark 103 Led by: Rob Thompson, Carleton College MAA-NCS Student Activities Coordinator
8:00 – 9:00	**Community and Belonging in Mathematics** Stark 103 Aaron Wangberg, Presiding Deanna Haunsperger, Carleton College
9:00 – 10:00	**Reception** Science Learning Center (SLC) Atrium

One of our Saturday sessions is organized by MITN. MITN is short for *Minnesota Inquiry Teaching Network* and is pronounced "mitten". Our goal is to build a community of people interested in using Inquiry-Based Mathematics Education in the classroom. We organize in-person gatherings in (or near) the Twin Cities, online activities, and events at the North Central Section meetings.   For questions contact Organizer Su Dorée doree@augsburg.edu. To be added to our mailing list contact Information Director, Rebecca Glover rebecca.glover@stthomas.edu.

Thank you to Winona State University, faculty, staff and students involved in the effort of hosting this meeting.

Saturday, March 25, 2023 (7:30am – 2:55pm)

Time		
7:30 – 11:00	**Registration and Breakfast** Science Learning Center (SLC) Atrium	
7:45 – 8:20	**Business Meeting** Stark 103 Aaron Wangberg, MAA-NCS President	
8:25 – 8:30	**Welcome by Dr. Charla Miertschin, Dean of the College of Science and Engineering, Winona State University**	
8:30 – 8:55	**Modeling Workshop with Desmos** Stark 103 Joyati Debnath, Presiding Jacob Duncan and Aaron Wangberg, Winona State University	
	Stark 108 (MITN) Aaron Wangberg, Presiding	**Stark 106** Steve Leonhardi, Presiding
9:00 – 9:20	**Experiencing Mathematical Inquiry, Part 1: Live Classroom** Matthew Haines, Augsburg University	**The Infected Checkerboard** David Radcliffe, Independent
9:25 – 9:45	**Experiencing Mathematical Inquiry, Part 2: The Four Pillars of IBL** Su Dorée, Augsburg University	**Lines and Regions; What Am I Missing?** Tom Sibley, CSB/SJU
9:45 – 9:55	**Break**	
	Stark 108 (MITN) Eric Errthum, Presiding	**Stark 106** Steve Leonhardi, Presiding
9:55 – 10:15	*Pointless Grading and Why You Should Try It! (I)* **Installing a Bar: Blending Ungrading and Specs Grading** Anne Sinko, CSB/SJU **Abandon All Grades, Ye Who Enter Here** Jeff Ford, Gustavus Adolphus College **Motivation Through Connection** Robert Campbell, CSB/SJU **Making Grading More Enjoyable Through Student Interviews** Bret Benesh, CSB/SJU	**A Balancing Partition Game** Jeremiah Bartz, UND
10:20 – 10:40	*Pointless Grading and Why You Should Try It! (II)* **Harry Potter Grading for Higher Ed** Kris Hollingsworth, MSU, Mankato **EMbRaciNg Mastery-Based Grading** Eric Errthum, Winona State University **Specifications for Computations** Matthew Wright, St. Olaf College	**How High! Experiment-Driven Modeling of Free Fall with Air Drag** Jacob Duncan, Winona State University
10:45 – 11:05	*Pointless Grading and Why You Should Try It! (III)* **A First Attempt to Ungrade Topology** Lori Zieglelmeier, Macalester College **Undoing Ungrading** Dale Buske, St. Cloud State University **Small Class = Time to Experiment!** Kristen Selke, Saint Mary's University of Minnesota	**Math After School is Fun!** Monica Evers (U), Patricia Corbera (U), Sophia Scheveck (U), Aaron Wangberg Winona State University

	Saturday, March 25, 2023 (7:30am – 2:55pm)	
11:10 – 12:10	**The Power of Talk: Engaging the Public in Mathematics** Stark 103 Aaron Wangberg, Presiding Talithia Williams, Harvey Mudd College	
12:15 – 1:45	**Lunch**	
	Stark 108 Steve Leonhardi, Presiding	**Stark 106** Barry Peratt, Presiding
1:45 – 2:05	**A Friendly Introduction to Abstract Algebra** Ryota Mastuura, St. Olaf College	**Convex Hull Games on Graphs** Brett Benesh, CSB/SJU
2:10 – 2:30	**The Image of a Mathematician and its Toxic Effect on Student Belonging** Robert Campbell, CSB/SJU	**Oh What a Complex Rug We Weave...** Barry Cipra, Freelance and Paul Zorn, St. Olaf College
2:35 – 2:55	**Some Algebraic Techniques for Ramsey Theory** Bryce Christopherson, UND	**Infinite Families of Infinite Series with Integer Sums** James Sellers, UM Duluth

Abstracts

Invited Addresses

Deanna Haunsperger, Carleton College,
Community and Belonging in Mathematics

How can we change the face of mathematics to include more women and members of underrepresented groups? We can consciously build more communities to welcome in people who have been historically underrepresented in mathematics and make them feel like they belong.

Talithia Williams, Harvey Mudd College & MAA Pólya Speaker,
The Power of Talk: Engaging the Public in Mathematics

When it comes to inspiring the future productivity and innovation of our nation, mathematicians are the on the front lines. In this talk, I will discuss the importance of engaging a wide range of audiences in conversations about the nature of our work and of scientific discovery. As we change the way communities think about the natural world and the STEM disciplines, we can begin conversations that improve public perception of science and bring people from all backgrounds into this important work.

Workshops

Modeling Workshop with Desmos
>Jacob Duncan and Aaron Wangberg, Winona State University

Bring your laptop to this workshop and experience the amazing capabilities hidden within Desmos for matching mathematical models with real data. We'll construct models for science and business applications, explore the powerful features within Desmos that allow instructors and students to engage meaningfully with data, and discuss how these capabilities are changing conversations in the mathematics classroom.

Experiencing Mathematical Inquiry, Part 1: Live Classroom
>Matthew Haines, Augsburg University

Join us to experience inquiry as the learner in this workshop. There will be time to reflect on this experience and how it connects to the Four Pillars of IBL. (Never heard of those -- no problem, join us to find out!) Part 1 is the live classroom; Part 2 is the presentation and discussion

Experiencing Mathematical Inquiry, Part 2: The Four Pillars of IBL
>Su Dorée, Augsburg University

Join us to experience inquiry as the learner in this workshop. There will be time to reflect on this experience and how it connects to the Four Pillars of IBL. (Never heard of those -- no problem, join us to find out!) Part 1 is the live classroom; Part 2 is the presentation and discussion. While it is recommended that you attend both parts, Part 2 will make sense even without Part 1.

Lightning Talks: Pointless Grading and Why You Should Try It!

Have you ever gotten fed-up enough with struggling to decide if student work is worth 6 or 7 points out of 10? What did you do instead? Come and listen to short talks about the use of alternative grading: standards-based grading, specifications grading, ungrading, or something entirely new! Find about successes, failures, and questions with your fellow faculty.

Session 1:
>**Installing a Bar: Blending Ungrading and Specs Grading**
>Anne Sinko, College of Saint Benedict and Saint John's University
>>**Abstract:** The student independence of ungrading can be overwhelming for students, particularly students new to alternative assessments, so I added a C-level bar to Calculus to blend ungrading and specifications.

>**Abandon All Grades, Ye Who Enter Here**
>Jeff Ford, Gustavus Adolphus College
>>**Abstract:** We'll cover the struggles and successes of a first attempt to implement ungrading.

>**Motivation Through Connection**
>Robert Campbell, College of Saint Benedict and Saint John's University
>>**Abstract:** I have found success in motivating students through regular personal connection and communication.

>**Making Grading More Enjoyable Through Student Interviews**
>Bret Benesh, College of Saint Benedict and Saint John's University
>>**Abstract:** I will describe a process I used in an ungrading classroom to make oral exams useful for knowing what students know, useful for helping students know how to improve, and useful for making "grading" much more enjoyable for both the students and me.

Session 2:

Harry Potter Grading for Higher Ed

Kris Hollingsworth, Minnesota State University, Mankato

Abstract: This lightning talk will introduce the EMRN Grading Rubric as a tool for formative assessments designed to help students productively respond to and adapt to feedback on graded assignments with possibilities for revision, and how I have used this rubric both successfully and less successfully in previous classes as part of specifications grading.

EMbRaciNg Mastery-Based Grading

Eric Errthum, Winona State University

Abstract: I'll discuss the pros and cons of my experience with the EMRN mastery-based grading scale.

Specifications for Computations

Matthew Wright, St. Olaf College

Abstract: A switch from partial credit to feedback-and-revision for computational assignments resulted in less frustration and higher quality student work, but efficient evaluation remains elusive.

Session 3:

A First Attempt to Ungrade Topology

Lori Ziegelmeier, Macalester College

Abstract: This semester, I am trying ungrading in my senior-level capstone course Topology in order to emphasize to students the focus on learning rather than the accumulation of points.

Undoing Ungrading

Dale Buske, St. Cloud State University

Abstract: After dipping my toes into ungrading in Calculus 2 one term, I fled - this is why and where I landed.

Small Class = Time to Experiment!

Kristen Sellke, Saint Mary's University of Minnesota

Abstract: Ten weeks into Modern Geometry during Spring 2023 and I'm on my third (or is it fifth?) grading plan.

Contributed Talks

Jeremiah Bartz, University of North Dakota,

A Balancing Partition Game

In this talk, we introduce a combinatorial balancing game involving integer intervals. More precisely, we say the integer interval $[a..b] = \{a, a+1, \ldots, b\}$ is a *balancing interval* if some central terms of the interval can be deleted and the remaining left and right subintervals share the same sum. For example, $[2..5] = \{2,3,4,5\}$ is a balancing interval since deleting 4 gives the identity $2 + 3 = 5$. Existence criteria and construction algorithms are discussed. Partition theory plays a useful role.

Bret Benesh, The College of Saint Benedict and Saint John's University,
    Convex Hull Games on Graphs

There is a natural way of defining the convex hull of a subset of vertices of a graph, and we define the following 2-player game on a graph. The players alternate selecting one vertex. After each selection, we compute the convex hull of the set of all selected vertices. A player wins when the convex hull equals the entire set of vertices.

We studied this game and three variations of it. We determined outcomes and nim-numbers for many families of graphs, and we found a surprising connection to the well-known game Dawson's Chess.

Robert Campbell, The College of Saint Benedict and Saint John's University,
    The Image of a Mathematician and its Toxic Effect on Student Belonging

Underrepresentation in mathematics is a complex issue. One component is the perception society creates of who a mathematician is. This dubious image contributes heavily to students' misperceptions of their own ability and detracts from their sense of belonging in mathematics. I believe that aggressive and substantial intervention is necessary to combat this plague on our field.

Bryce Christopherson, University of North Dakota,
    Some Algebraic Techniques for Ramsey Theory

Broadly, Ramsey theory is the branch of mathematics that studies an as-of-yet poorly understood mathematical phenomenon which seems to dictate that the local structure of sets of objects belonging to some larger class necessarily becomes more regular as the quantity of objects in the set increases beyond a certain bifurcation point, provided the class itself possesses a suitable degree of global structure. Usually, a generic Ramsey-theoretic problem seeks to determine the precise value at which this bifurcation occurs. In this talk, we sketch a significantly more general extension of classical Ramsey numbers and characterize them using some algebraic techniques to argue that, while our ability to compute the specific values of such quantities may be limited, the interplay between and overall structure of Ramseyian objects is not.

Barry Cipra, Freelance and Paul Zorn, St. Olaf College,
    Oh What a Complex Rug We Weave...

Surprising patterns emerge when we obey a simple mathematical rule, borrowed from knot theory, for tricoloring a square weave of "ribbon" or "thread," starting from specified "fringe" conditions across the top and left edges. We report on some of what we've observed and appeal for help in proving that the patterns persist as the weaving goes to infinity.

Jacob Duncan, Winona State University,
    How High! Experiment-Driven Modeling of Free Fall with Air Drag

Most free fall models are based on the assumption that gravity is the only force acting on the object. In this talk, I discuss a SIMIODE modeling scenario centering around the construction of a free fall model that accounts for the force of air drag. In the module, students develop, solve, and analyze a second order nonhomogeneous differential equation model for free fall which incorporates air resistance. Students solve the model using two different methods – reduction of order and separation of variables, and method of undetermined coefficients. Using the solution, students derive an expression for the terminal velocity of the object as well as a prediction of the maximum height of the object. The model is then parameterized for a Nerf dart by an experiment performed by students. The terminal velocity and muzzle velocity of the dart are measured using video frames of the dart's motion. Finally, the model is validated by an experiment wherein students fire their darts upward and measure the assent time for comparisons with their predictions.

Monica Evers (U), Winona State University, Patricia Corbera (U), Winona State University, Sophia Scheveck (U), Winona State University, and Aaron Wangberg, Winona State University
Math After School is Fun!

We started a math club for 2nd - 5th grade students. By emphasizing creativity, critical thinking, and teamwork skills, we had a lot of fun helping students work on hard problems. In this talk, we'll share the successes (and pitfalls!) we experienced with the club and reveal tips for adapting hard problems for students with a wide variety of math abilities.

Ryota Matsuura, St. Olaf College,
A Friendly Introduction to Abstract Algebra

We will describe a new approach to laying a foundation for abstract mathematics. When students generalize from a wide range of examples, they are better equipped to conjecture, formalize, and prove new ideas. Thus, they should explore concepts through illuminating examples before formal definitions/theorems are introduced. Rather than merely consuming mathematical knowledge, students should learn mathematics by actively creating mathematics.

Abstract algebra often acts as "gateway" to completing a mathematics major. But it can seem impenetrable due to its (seemingly) theoretic nature. By taking a more concrete approach and allowing students to develop their own understanding, we can make abstract algebra more accessible to more students.

David Radcliffe, Independent,
The Infected Checkerboard

Peter Winkler proposed the following problem. An infection spreads among the squares of an $n \times n$ checkerboard in the following manner. If a square has two or more infected neighbors, it becomes infected itself. (Each square has 4 neighbors only!). Prove that you cannot infect the whole board if you begin with fewer than n infected squares. I will discuss the original problem, and present new results for the variant where a square requires three or more infected neighbors to become infected.

James Sellers, University of Minnesota Duluth,
Infinite Families of Infinite Series with Integer Sums

Motivated by some of the results in Jakob Bernoulli's *Tractatus de Seriebus Infinitis*, I will share recent work with Damiano Fulghesu and Courtney Taylor that provides a formula for the exact sums of infinitely many infinite series (whose convergence is easily proven with the ratio test). The proofs of our results are truly elementary, and provide an affirmative answer to this question: Can we find an infinite family of infinite series whose sums are INTEGERS? The talk will be accessible to, and hopefully enjoyable for, faculty and students alike.

Tom Sibley, St. John's University and College of St. Benedict (retired),
Lines and Regions; What Am I Missing?

The minimum and maximum numbers of regions determined by n lines in the plane are well known. What about the in between numbers? What's missing and where can we find them?

2023 MAA NCS Summer Seminar: Mathematics and Data for Social Justice June 7-9, 2023 at Augsburg University

The Mathematics and Data for Social Justice Summer Seminar (NSF #2303556) is a three-day seminar designed to equip North Central Section math and statistics faculty with skills and practices to meaningfully incorporate social justice themes in their classrooms and curricula. The seminar will include workshops led by national experts Dr. Lily Khadjavi and Dr. Gizem Karaali, as well as panels on facilitating effective classroom discussion with students. Participants are expected to continue collaborating and learning in 2023-2024 via special topics sessions at the North Central Section MAA meetings and on MAA Connect.

The Seminar capacity is 30 instructors. The NSF is heavily funding the seminar, reducing expenses for participants to $100 registration fee, their local housing costs, meals, and their own travel expenses.

The NSF has provided travel support of $250 for 25 participants as well as care funds of $150 (for each of 25 participants) to support seminar participation.

In order to ensure we maximize the impact of our NSF funding, we are asking potential seminar participants to share with us:

- The opportunities (and challenges) of implementing materials in their classrooms during the 2023-2024 academic year
- The ability to continue collaborating and engage a community of practice in the 2023-2024 academic year
- The ability to share their experiences through dissemination at MAA NCS Section meetings or at their own institution

Dr. Lily Khadjavi is a Professor and Chair of Mathematics at Loyola Marymount University in Los Angeles. Dr. Khadjavi's scholarly activity lies in the intersections of mathematics and social justice and in broadening participation in the mathematical sciences. Her research includes a focus on policing and the issue of racial profiling, and in 2020 she was appointed by California State Attorney General Xavier Becerra to the Racial and Identity Profiling Act Board which works with the California Department of Justice. Since 2016, she has served as Principal Investigator for the Association for Women in Math's National Science Foundation-funded travel and mentoring grant program.

Dr. Gizem Karaali is professor of mathematics at Pomona College. She is a founding editor of Journal of Humanistic Mathematics (https://scholarship.claremont.edu/jhm/) and a senior editor of Numeracy (digitalcommons.usf.edu/numeracy/), the journal of the National Numeracy Network. Karaali has published over a hundred articles as well as four edited volumes. In the last decade, Karaali received federal grants for her research and teaching (from the National Security Agency and the National Endowment for the Humanities). Through her career, she has served the MAA's Special Interest Group on Quantitative Literacy (SIGMAA-QL) in various capacities, chairing it in 2018-2020, and organized or facilitated several paper sessions and professional development workshops for mathematics faculty and K-12 teachers on a wide range of themes such as humanistic mathematics, teaching math for social justice, and writing. Karaali is a Sepia Dot (a 2006 Project NExT Fellow).

MAA-NCS 2023 Summer Seminar Planning Team:
    John Zobitz, Augsburg University, **Megan Breit-Goodwin**, Anoka-Ramsey Community College, **Aaron Wangberg**, Winona State University and **Julia Walk**, Concordia College

More information can be found at: https://www.northcentral.maa.org/maa-ncs-2023-summer-seminar

Wireless Access at Winona State University

WSU Guest

Visitors to the Winona campus can enjoy wireless access with a temporary account on our WSU Guest wireless network.

To access:

1) Open your device's wireless settings
2) Select **WSU Guest**

      This should open a web browser to the Winona State University Guest Network page.
      Select the box for "I accept the Terms of Service".

      Choose "**Sign in with Email**" or "**Sign in with Text Message**."

3a) If you chose "**Sign in with Email**":
      Type your name and email address in the required fields.
      Select "**Send Access Code.**"
      An email from no-reply@mist.com will be sent to the email address.
      Type the access code from the email in the access code field and select "Sign in."

3b) If you chose "**Sign in with a Text Message**":
      Type your name and email address in the required fields.
      Choose your Mobile Carrier and type your Mobile Number (without spaces or dashes).
      Then select "**Send Access Code.**"
      A text from no-repy@mist.com will be sent to the mobile number with a code.
      Type the access code from the text message in the access code field and select "Sign in."

If you need internet access to retrieve the access code, the Registration table can help.