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Education

2012 - 2018 | **Ph.D. in Mathematics**, *The University of Chicago* — Chicago, IL
- **Advisor** - Danny Calegari
- **Dissertation Title** - Self-similarity of Ziggurat Fringes and Rigidity of Extremal Free Group Actions on the Circle

2012 - 2014 | **M.S. in Mathematics**, *The University of Chicago* — Chicago, IL
- **Topic Proposal** - Stable Commutator Length and Quasimorphisms

2009 - 2012 | **Bachelor of Mathematics with Honours**, — Bengaluru, KA, India
Indian Statistical Institute, Bangalore Centre
- First Division with Distinction, highest CGPA in program in graduating year.

Academic Appointments

2023 - Present | **Assistant Instructional Professor**, *The University of Chicago* — Chicago, IL
(in the Physical Sciences Collegiate Division and the Department of Mathematics)
- Section Leader, Elementary Functions and Calculus I-II-III, Math 131-132-133 (2023 - 2025)
- Coordinator for the Math 130s Tutorial Program, overseeing all tutorial content, logistics, and the training and development of undergraduate Junior Tutors

2020 - 2023 | **Visiting Assistant Professor**, *The College of Wooster* — Wooster, OH
- Introduction to Topology, Math 330 (Fall 2021)
- Numerical Analysis, Math 327 (Spring 2022)
- Chaotic Dynamical Systems, Math 299 (Spring 2023)
- Teaching Apprenticeship, IDPT 398 (Spring 2022)
- Putnam Seminar, Math 27901 (Fall 2021, Fall 2022)
- Differential Equations, Math 221 (Fall 2020*)
- Multivariate Calculus, Math 212 (Spring 2022, Fall 2022)

- Transition to Advanced Mathematics, Math 215 (Spring 2021*, Fall 2021, Fall 2022)
- Mathematical Foundations of Computing, Math 130 (Spring 2022, Spring 2023)
- Theory of Integral Calculus, Math 125 (Fall 2022, half-semester)
- Theory of Differential Calculus, Math 115 (Fall 2021, half-semester)
- Applied Differential Calculus, Math 110 (Spring 2023, half-semester)
- Calculus and Analytic Geometry II, Math 112 (Spring 2021*)
- Calculus and Analytic Geometry I, Math 111 (Fall 2020*)

* online and hybrid versions

2018 - 2020 **Visiting Assistant Professor**, *Bowdoin College* Brunswick, ME

- Ordinary Differential Equations, Math 2208 (Fall 2019, Spring 2020)
- Linear Algebra, Math 2000 (Spring 2019)
- Multivariable Calculus, Math 1800 (Fall 2018, Spring 2019, Fall 2019, Spring 2020),
- Differential Calculus, Math 1600 (Fall 2018)

Jun 2018 - Aug 2018 **Mathematics Instructor, Chicago Academic Achievement Program**, *The University of Chicago College* Chicago, IL

- Proof-Based Methods in Mathematics

2014 - 2018 **Graduate Student Instructor**, *The University of Chicago* Chicago, IL

- Mathematical Methods for Social Sciences, Math 195 (Winter 2018, Autumn 2017)
- Linear Algebra, Math 196 (Summer 2017),
- Calculus III, Math 153, (Winter 2017, Winter 2016, Spring 2015)
- Calculus II, Math 152 (Autumn 2016, Autumn 2015, Winter 2015),
- Calculus I, Math 151 (Autumn 2014)
- Elementary Functions and Calculus III, Math 133 (Spring 2016)

2013 - 2017 **Grader for Graduate Courses**, *The University of Chicago* Chicago, IL

- Riemannian Geometry taught by André Neves (Spring 2017)
- Differential Topology taught by Danny Calegari (Winter 2016)
- Differential Geometry taught by Sidney Webster (Winter 2015)
- Algebraic Topology taught by Danny Calegari (Autumn 2013)

Administrative Experience

2024 - Present **Coordinator, Math 130s Collaborative Learning Tutorial Program**, *The University of Chicago*

- Oversaw the transition of the traditional Math 130s tutorial program into a formal Collaborative Learning (CL) model grounded in pedagogical research and designed the Lead Junior Tutor position
- In the initial year, managed all program logistics, including authoring biweekly tutorial problem sets and weekly quizzes for a sequence serving over 300 students.
- Developed and led a comprehensive, year-long Pedagogy and Content Analysis training program for a cohort of up to 42 undergraduate Lead Junior Tutors (LJTs) and several Graduate Teaching Assistants (GTAs).
- Designed and facilitated a multi-day Orientation Boot Camp on collaborative learning theory (e.g., constructivism, metacognition) and practice.
- Authored a formal, criterion-based evaluation rubric from scratch to assess Junior Tutor performance, clarify job expectations, and inform rehiring decisions.
- Conducted tutorial observations and provided formative feedback to LJTs to identify training needs.
- Collected and analyzed student survey data on the collaborative learning program to guide future improvements

Grant Support

2024-2025 **Exploratory Teaching Group**, *Chicago Center for Teaching and Learning*
- *"Discussion on Implementing Alternate Grading and Redesigning Assessment in Math"*, co-chaired with Kale Davies. Amount: $1000

2024-2025 Co-author of **Collaborative Learning Problem Bank**, supported by **College Curriculum Innovation Fund**, *The University of Chicago College*
- Created in collaboration with Kale Davies, supported by a fund awarded to Britni Ratliff and Zsuzsanna Szaniszlo. Amount: $10000

2023-2024 **Senior Personnel (Faculty)**, National Science Foundation IUSE Grant Proposal, *The University of Chicago*
- Collaborated with Britni Ratliff and Zsuzsanna Szaniszlo on a grant application for the Improving Undergraduate STEM Education program, authoring the mathematics portion of the proposal

Mentoring and Advising

2024 - Present **Professional Development in Teaching Provider** for **Third Year Graduate Student Lecturers**, *The University of Chicago Mathematics Department*
- Jointly with Sarah Ziesler
- Co-developed and led workshops on *Understanding cognitive demand*, *Designing exam questions*, *Interpreting student feedback*, and *Syllabus design*.

- Provided informal mentoring to first-time GSLs on effective student communication, grading strategies, and syllabus feedback.

2023 - Present

Mathematics Advisor for the **Neubauer Phoenix STEM Scholars Program**, *The University of Chicago College, Office of Research and Teaching Innovation*

- Advised Phoenix STEM scholars about their Math, Statistics, CAAM, Data Science, and Computer Science curriculum
- Advised scholars on applications for summer research programs (REUs) and other career development opportunities
- Conducted weekly drop-in help sessions for the scholars
- Taught the Math component of a two-week boot camp in Orientation week
- Participated in cohort meetings during the academic year
- Created and maintained communication channels between the Phoenix STEM director and the scholars

2021 - 2023

Advisor for Senior Independent Study (Bachelor's Thesis), *College of Wooster*

- Lucy Wickham, 2022 - 2023
  "Tile Invariants and an Exploration of Tilings with Ribbon Pentominoes and L-Pentominoes".
- Michael Curran, 2022 - 2023
  "Isometric Immersion: Hilbert's Theorem and the Case of the Hyperbolic Plane"
- Ussama Mustafa, 2022 - 2023 (jointly with the CS department)
  "Exploring the Power of Generative Architectures such as GANs, Transformers, and VQGAN+CLIP through the Construction of an Illustrated Storybook Generator"
- Sabrina Helck, 2021 - 2022
  "The Infinity Conundrum: Understanding Topics in Set Theory and the Continuum Hypothesis".
- Molly Hutter, 2021 - 2022
  "In Hot Water! Using Numerical Analysis to show the Effects of Climate Change on the Great Lakes".

2021 - 2022

Supervisor for Applied Methods and Research Experience, *College of Wooster*

- **Summer 2022**: Funded by Goodyear Tire and Rubber Company - Innovation Technology division, students were tasked with creating a comprehensive analysis application for their non-pneumatic tires using Python, converting multi-program routines involving complex data structures and cutting-edge numerical methods, into one standardized workflow.
  Supervisees: Ussama Mustafa, Praneel Panchigar, Kevin Yuan

- **Summer 2021**: A client-funded research project, where students were tasked with understanding trends in customer behavior at a regional grocery store chain, analyzing halo effects, and coming up with creative targeted programs to increase sales using customer segmentation techniques.
  Supervisees: Abigail Breitenbucher, Luke Pritchard, Maya Vasta, Kweku Yamoah

Spring 2019 | **Advisor for Intermediate Independent Study**, *Bowdoin College*
- Theo de Quillacq, 2020 - *Machine Learning*
- Arav Agarwal, 2020 - *Group Theory*

2020 - 2021 | **Second Reader for Senior Independent Study**, *College of Wooster*
Independent studies where I have been a committee member and reader
- Joaquin Abos Amo, 2021,
  "A Game Theoretical Analysis of War Situations and International Conflict"
- Rephael Berkooz, 2021
  "Musical Feature Engineering with Wavelet Analysis for Music Recommendation"
- Molly Hutter, 2020
  An Investigation into Finite Difference Methods in Solving a Reaction-Diffusion System to Model the Spread of Wildfires
- Alayt Issak, 2020
  "Visualizing Concepts: Generative Adversarial Network (GAN) visuals synthesized from semantic vectors"

2019 | **Second Reader for Honors Project**, *Bowdoin College*
- Rosa Rossi-Goldthorpe, 2019
  "Modeling the Mechanism of Lithium in the Treatment of Bipolar Disorder"

2014, 2016 | **Advisor for Summer Research Experience for Undergraduates**, *The University of Chicago*
- M. C. Welsh, 2016, *Scissors congruence*
- S. Park, 2016, *Rationality of zeta functions over finite fields*
- E. Hsiao, 2016, *Canonical energy and black hole stability*
- L. Linov, 2014, *An introduction to knot theory and the knot group*
- J. H. Yoo, 2014, *The Jordan-Chevalley decomposition*

2014 - 2016 | **Mentor for Directed Reading Program**, *The University of Chicago*
- Dan Su, Winter 2016, *Topology*
- Wenyu Chen, Autumn 2015, *The Dynamics of Circle Homeomorphisms*
- Weston Ungemach, Spring 2014, *Discrete Group actions on Topological Spaces*

2014 - 2016 | **WOMP Mentor**, *The University of Chicago*

- Warm-up program organized and run by advanced graduate students for incoming grads in the math department

2010 - 2011 | **Instructor in Regional Mathematical Olympiad and National Mathematical Olympiad Training Camp**
- in Kolkata, West Bengal and Bangalore, Karnataka, India

Curriculum Development

2024 - 2025 | Redesigned Math 130s Curriculum to implement **Mastery-Based Grading**, *The University of Chicago*
- Worked in collaboration with Kale Davies
- Overhauled the course structure using a backward-design approach, e.g., centering the Math 133 curriculum on Taylor series to motivate the study of sequence and series convergence
- Created Learning Targets for assessment and problem banks aligned with those targets

2023 - Present | Developed **Interactive Course Materials**, *The University of Chicago*
- Authored a full suite of interactive worksheets for the Math 130s sequence, designed to foster active learning, collaborative problem-solving, and in-class discovery in place of traditional lecture

Spring 2023 | Created **Chaotic Dynamical Systems** (Math 29904) course, *College of Wooster*
- Developed new content including syllabus, course notes, exams, and `OCTAVE` projects.

Spring 2021 | **Calculus Review and Restructure**, *College of Wooster*
- Helped subdivide gateway courses to fine-tune student placement and increase accessibility
- created new MCQ question bank for placement tests

Other Professional Service

2024 - 2025 | **Graduate Student Lecturer Observation**, *The University of Chicago*
- Formally observed five GSLs and Phoenix GTAs, provided verbal feedback, and submitted written reports to the department

2024 - 2025 | Authored **Lead Junior Tutor Evaluation Rubric**, *The University of Chicago*

- Researched and created a comprehensive, criterion-based rubric for evaluating undergraduate teaching assistants in consultation with the Chicago Center for Teaching and Learning (CCTL) and the Director of STEM Pedagogy.
- The rubric was adopted for the program going forward.

2023 - 2025 | Participant, **Search Committees**, *The University of Chicago*

- Attended teaching demonstrations and met with candidates for searches in both the Math Department and the CCTL, providing written feedback to the committees

2023 - 2024 | **AIP Subcommittee to select Online Homework Platform**, *The University of Chicago*

- Scheduled and met with representatives from different vendors,
- Researched university and administrative regulations for the decision process
- compared and contrasted various pros and cons and worked on a report for the Senior Instructional Faculty

2023 - Present | Member of the **Mathematical Association of America**

- Active member of College Mathematics Instructor Development Source (**CoMInDS**) community
- Active member of Special Interest Group on Inquiry-Based Learning (**SIGMAA IBL**) since 2025

2015 - 2018 | **The University of Chicago College Calculus Accreditation Exam**, under the supervision of Jitka Stehnova and John Boller

- Created a MCQ question bank (2018)
- Graded subjective answers
- Designed sorting criteria and algorithm
- Processed large data sets using Excel and Python

2021 - 2023 | **Primary Faculty Advisor, The Student Mathematical Association of America Club**, *College of Wooster*

- Student organization promoting opportunities for community development within the mathematics department and for increasing mathematics awareness on and around campus

Summer 2021 | **Creating Guides for incoming international students in STEM**, *College of Wooster*

- Supported by Great Lakes Colleges Association Internationalization grant

2018 - 2020 | **Co-organizer, Problem Solving Session**, *Bowdoin College*

- Training undergraduates in problem solving strategies for *Putnam Competition*

2019 - 2020 | **Co-organizer, Student of Color Study Group**, *Bowdoin College*

- Weekly study group for underrepresented students in Math, CS and Physics

2019 | **Judge, MAA Undergraduate Poster Session**, *JMM 2019*, Baltimore, MD

2015 | **Judge, QED Young Math Symposium**, *Math Circles of Chicago*
- Chicago's only youth math symposium

2014 - 2019 | Member of the **American Mathematical Society**

2014 - 2018 | Webmaster and active member of the UChicago chapter of **Association for Women in Mathematics**

2014 | **Organizer & Moderator, AWM Postdoc Panel**, *The University of Chicago*
- Regarding application process, job market etc.

Professional Development

2024 - 2025 | **Pedagogy Fellows Program**, *Chicago Center for Teaching and Learning*
- Selected as part of a competitive, year-long cohort of 15 faculty members; awarded a $1000 grant for completion of the program.
- Focused on the pedagogical redesign of the Collaborative Learning (CL) Junior Tutor training program syllabus
- Attended a series of structured workshops on key topics including equitable assessment, inclusive pedagogy, and active learning strategies.
- Engaged in paired peer observations and received a formal mid-course review from CCTL leadership to refine the training program.

Summer 2024 | **OPEN Math MAA Workshop**, *Mathematical Association of America*
- Attended the 27-hour online workshop titled *"Designing Professional Development Programs for Graduate Student Teaching Assistants"* as a team with Sarah Ziesler
- Learned about available resources, including the College Mathematics Instructor Development Source (CoMInDS) online community and video case study repository
- Created and presented a capstone poster outlining a revamped professional development program for Graduate Student Lecturers in the UChicago Math Department
- Received a certificate of completion from the MAA for active participation

2023 - 2025 | **Exploratory Teaching Groups (ETGs)**, *Chicago Center for Teaching and Learning*

- **Co-Chair**, *Discussion on Implementing Alternate Grading and Redesigning Assessment in Math* (2024-2025)
  - Co-chaired a CCTL-funded group of six junior math faculty that met twice per quarter to discuss alternative grading using the book *Grading for Growth* as a focal text
  - The group's goal was to establish a cohort of instructional faculty interested in collaboratively adopting Mastery-Based Grading (MBG) in their teaching
- **Participant**, *Collaborative Learning Methodology and Approach* & *Team Leader Training in the Collaborative Learning Program* (2023-2025)
  - Participated in a multi-year group with faculty from Chemistry, Biology, and Statistics to design, implement, and assess collaborative learning pedagogies
  - Focused on designing effective student surveys and analyzing feedback data to evaluate the success of the CL program

April 2024

Critical Issues in Mathematics Education Conference, *Simons Laufer Mathematical Sciences Institute*

- Three-day workshop (attended online) titled *"Bringing Innovation to Scale: Teaching-Focused Faculty as Change Agents"*
- The program focused on how teaching-focused faculty can partner with departmental leaders to improve student outcomes, coordinate courses, and provide professional development for graduate students

2023 - 2025

Chicago Center for Teaching and Learning Programs, *The University of Chicago*

- **September Symposium**: Attended the annual orientation workshop for new and returning instructors (September 2023, September 2024). Topics included: Interactive Lecturing, Pedagogical Reflections on Generative AI, Inclusive Pedagogy, Importance of Trust in Classroom, and Feedback for Student Learning
- **Lunchtime Reading Groups**:
  - *"The Hidden Curriculum"* by Rachel Gable (Winter 2025)
  - *"Grading for Growth"* by Clark and Talbert (Winter 2024)

- **Workshops and Panel Discussions**: Attended sessions including *Pedagogy in the Physical Sciences* (March 2024), *Assessing and Using Prior Knowledge in 9 Weeks* (April 2024), and the *Spring Pedagogy Symposium* on the Imposter Phenomenon (April 2024)

2023 - Present

Mathematics Department Pedagogy Seminar, *The University of Chicago*

- Regular and active participant in weekly one-hour meetings focused on mathematics-specific teaching practices

- Engaged in discussions based on readings from the *MAA Instructional Practices Guide* and books such as *"Inclusive Teaching: Strategies for Promoting Equity in the College Classroom"*, *"Teaching At Its Best"*
- Presented talks titled *"Collaborative Learning in Undergraduate Mathematics"* and *"Understanding Intellectual Growth - Applying Perry's Scheme to Support Metacognition"*
- Served as a panel member and discussion facilitator on multiple occasions

2020 - 2023 **Inclusive Teaching Workshops**, *College of Wooster*

- Three-hour workshops every August run by STEM Success Initiative.
- Workshops include: inclusive practices for teaching, grading, and assessment; supporting diverse students.

2021 **Assessment Workshop**, *College of Wooster*

- One-hour workshop run by Dr. Missy Schen, Assessment Director.
- Workshop includes setting goals for course, writing clear and fair assessment items, and pros/cons of different assessment types.

2021 - 2024 **The Grading Conference**, *Virtual*

- Online conference every June supported by NSF grant
- Topics cover alternate grading practices (e.g., standards-based, specifications-based, etc.) to best support student learning and promote diversity, equity, and inclusion in the classroom

2013 - 2014 **College Fellow**, *The University of Chicago*

- Teaching Assistant for Honors Calculus I-III, Math 161-163 taught by Eugenia Cheng

Research Interests

Low-dimensional topological dynamics, especially the theory of nonabelian group actions on the circle. Theory of formal languages, with an aim to solve combinatorial group theory problems using topological methods. Broadly interested in geometric group theory, complex dynamics, and big mapping class group related topics as well.

Publications and Preprints

- **Ziggurat fringes are self-similar.** *Ergodic Theory and Dynamical Systems*, doi:10.1017/etds.2015.75

  In this paper, we give explicit formulae for fringe lengths of the Calegari-Walker Ziggurats – i.e. graphs of extremal rotation numbers associated to positive words in free groups. These formulae reveal (partial) integral projective self-similarity in ziggurat fringes, which are low-dimensional projections of characteristic polyhedra

on the bounded cohomology of free groups. This explains phenomena observed experimentally by Gordenko and Calegari-Walker.

- **A Topological proof that O_2 is 2-MCFL.** arxiv.org/abs/1710.04597

  In this paper, we give a new proof of Salvati's theorem that the group language O_2 is 2 multiple context free using homology theory. Unlike Salvati's proof, our arguments do not use any idea specific to two-dimensions. This raises the possibility that the argument might generalize to O_n.

Seminar and Conference Presentations

Aug 2025	*"Implementing Collaborative Learning through POGIL in High-Enrollment Calculus Tutorials"*, **Mathematical Association of America MathFest**, Sacramento, CA, USA
Aug 2025	*"Reflections from the Implementation of a Large-Scale SBG at UChicago"* (with Kale Davies), **Mathematical Association of America MathFest**, Sacramento, CA, USA
Oct 2024	*"Understanding Intellectual Growth: Applying Perry's Scheme"*, **Math Department Pedagogy Seminar**, *The University of Chicago*, Chicago, IL, USA
May 2024	*"Mastery-Based Grading"*, Presentation to College Fellows (with Kale Davies), **CCTL Workshop**, *The University of Chicago*, Chicago, IL, USA
Jan 2024	*"Collaborative Learning in Undergraduate Mathematics"*, **Math Department Pedagogy Seminar**, *The University of Chicago*, Chicago, IL, USA
Oct 2023	*"Rotation Number and The Slippery Conjecture"*, **AMS Fall Southeastern Sectional Meeting - Special Session on Ergodic Theory and Dynamical Systems**, *University of South Alabama*, Mobile, AL, USA
Mar 2022	*"Techniques Grading in an IBL-style Intro to Proofs Course"*, **Joint Mathematical Meetings - Project NExT session on Re-Imagining Grading: The Whys and Hows**, *Virtual*
Jan 2022	**Ohio Speaker's Circuit**, *Kenyon College*, OH, USA
Jan 2021	*"Rationality and Rigidity of Extremal Actions of Free Group on the Circle"*, **Joint Mathematical Meetings - AMS Special Session on Quantization for Probability Distributions and Dynamical Systems**, *Virtual*
Mar 2019	**Bowdoin College Department Seminar**, *Bowdoin College*, Brunswick, ME, USA
Apr 2018	**American Mathematical Society Spring Southeastern Sectional Meeting**, *Vanderbilt University*, Nashville, TN, USA
Jan 2018	**Joint Mathematical Meetings - AMS Special Session on Dynamical Systems: Smooth, Symbolic, and Measurable**, San Diego, CA, USA
Sep 2017	**American Mathematical Society Fall Eastern Sectional Meeting - Special Session on Geometric Group Theory**, *University at Buffalo*, Buffalo, NY, USA
Dec 2016	**Canadian Mathematical Society Winter Meeting - Session on Geometric Group Theory and Topology in Low Dimensions**, Niagara Falls, ON, Canada

Expository Talks in Student Seminars

Feb 2020	**Rotation Number and Dynamics on the Circle**, *College of Wooster*

Oct 2019	**Scissor's Congruence and Hilbert's 3rd Problem**, *Bowdoin College*
Nov 2018	**The Illumination Problem and Rational Billiards**, *Bowdoin College*
Apr 2018	**Rotation Number and Dynamics on the Circle**, *Bowdoin College*
Apr 2018	**Explorations in Circle Packings**, *The University of Chicago*
Apr 2017	**Hilbert's 3rd Problem and the Dehn Invariant**, *The University of Chicago*
Dec 2015	**Combinatorics of chessboard puzzles about domination, independence and tours**, *The University of Chicago*
Nov 2013	**Cut-Copy-Paste - Algebra and Tiling**, *The University of Chicago*
Feb 2013	**Stable Commutator Length**, *The University of Chicago*

Awards and Scholarships

2024 - 2025	**Pedagogy Fellows Program**, *Chicago Center for Teaching and Learning*
2012 - 2013	**McCormick Fellowship**, *The University of Chicago* Awarded by the Admissions Committee to a small number of highly rated applicants to the Ph.D. program of the Department of Mathematics
2012	**S.H. Aravind Gold Medal**, *Indian Statistical Institute* Awarded for outstanding performance in B.Math, to the student with the highest CGPA in the program.
2011	**Summer Research Fellowship**, *Indian Academy of Science*
2009	**Bronze medal, 50th International Mathematical Olympiad**, Germany
2009	**National Board of Higher Mathematics scholarship**, *Department of Atomic Energy*, Government of India
2008	**Kishore Vaigyanik Protsahan Yojana fellowship**, *Department of Science and Technology*, Government of India
2007	**National Talent Search Examination scholarship**, *National Council of Education Research and Training*, India

Research Conferences and Workshops Attended

May 2017	**2017 Georgia International Topology Conference**, *University of Georgia*
Apr 2016	**Bloomington Geometry Workshop**, *Indiana University*
Jun 2015	**Summer School in Geometry and Topology**, *The University of Chicago*
Jun 2015	**Diffeomorphism Groups Summer school**, *University of California, Berkeley*
May 2015	**Midwest Topology Seminar**, *The University of Chicago*
Jun 2014	**Thurston Legacy Conference**, *Cornell University*

Skills and Languages

Technical	C, Python, Haskell, Mathematica, Octave, PHP, HTML, CSS, LaTeX, MS Office
Language	English, Bengali, Hindi - fully proficient in speaking, reading, and writing