Subhadip Chowdhury

Department of Mathematics
The University of Chicago
5734 S. University Ave.
Chicago, IL 60637, USA

+1(773)490-5763
+1(773)702-7398
subhadip@uchicago.edu
subhadipchowdhury.github.io

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 the 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)
- Honors Calculus III, Math 163 (Spring 2026)
- Advanced Numerical Analysis, Math 212 (Winter 2026)
- Mathematical Methods in the Physical Sciences III (Differential Equations), Math 185 (Autumn 2025)
- Mathematical Methods in the Physical Sciences II (Multivariable Calculus), Math 184 (Summer 2025)
- Section Leader, Elementary Functions and Calculus I–III, Math 131–133 (2023–2025)
- Tutorial Coordinator, Math 130s Collaborative Learning Program (2024–present; see Program Leadership)

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)

Summer 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)

2013–2014 **College Fellow**, *The University of Chicago* Chicago, IL

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

Program Leadership

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

- Led the transition of the Math 130s tutorials from traditional problem sessions to a research-informed Collaborative Learning (CL) model
- Coordinated operations for a sequence serving 200–300 students; authored biweekly tutorial problem sets and weekly quizzes; oversaw tutorial-specific grading and feedback
- Maintained shared infrastructure across sections: course coordination document dividing duties

and responsibilities, weekly problems circulated to section leaders for review before release
- Designed, administered (Qualtrics), and analyzed end-of-quarter student evaluations and student surveys assessing the CL model
- Coordinated instructional-technology and communication workflows (Canvas, Gradescope, Ed Discussion, Box) and student-facing logistics: tutor-absence coverage, make-up and participation policies

2024–Present **Lead Junior Tutor Training Program, Math 130s Collaborative Learning Program**, *The University of Chicago*
- Designed the Lead Junior Tutor (LJT) role and its training and supervision system
- Developed and led a year-long Pedagogy and Content Analysis training program (up to 42 LJTs plus Phoenix GTAs) through weekly meetings; quarterly sequence from collaborative roles, to learning sciences, to knowledge creation
- Facilitated a multi-day Orientation Boot Camp on POGIL facilitation roles and collaborative-learning rationale
- Conducted tutorial observations with formative coaching; instituted a reciprocal peer-observation protocol with written reports used in pedagogy meetings
- Authored the **Lead Junior Tutor Evaluation Rubric** in consultation with the Chicago Center for Teaching and Learning (CCTL) and the Director of STEM Pedagogy; adopted for ongoing use
- Directed an LJT handbook project, with tutors co-authoring a best-practices record; restructured the training syllabus around explicit learning goals (CCTL Pedagogy Fellows Program project)

2024–2025 **Co-Chair, Exploratory Teaching Group on Alternate Grading and Assessment Redesign in Mathematics**, *Chicago Center for Teaching and Learning*
- Co-chaired a CCTL-funded group ($1,000 grant) of six junior mathematics faculty, meeting twice per quarter, to build a cohort prepared to adopt Mastery-Based Grading (MBG) collaboratively, using *Grading for Growth* as a focal text
- Developed shared language for evaluating student work and documented lessons from the Math 130s transition; multiple members implemented mastery-based grading in Autumn 2025 and coordinated assignments to share materials and streamline reassessment logistics

Curriculum and Course Materials Development

2024–2026 Developed **Collaborative Learning Problem Banks**, *The University of Chicago College*
- Math 152–153 (Summer 2026), problem bank for a Collaborative Learning pilot, co-created with Stephen Yearwood and supervised by Britni Ratliff (PSCD)
- Math 130s (Summer 2024), Collaborative Learning problem banks, co-created with Kale Davies and supported by the College Curriculum Innovation Fund

2025–2026 Redesigned **Honors Calculus III (Math 163)**, **Differential Equations (Math 185)**, and **Multivariable Calculus (Math 184)**, *The University of Chicago*

- Rebuilt each course around mastery-based grading: learning targets translated into assessable standards, new aligned assessment questions, reassessment scheduled within the quarter, and homework and projects redesigned to the same targets; Math 163 additionally uses a guided-discovery format with a holistic oral final examination

2024–2025 Redesigned Math 130s Curriculum to implement **Standards-Based Grading (SBG)**, *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

2023–Present Developed **Interactive Course Materials**, *The University of Chicago*

- Authored interactive worksheets as the primary in-class format, used each quarter across the calculus sequences and proof-based courses, 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

Mentoring and Advising

2024–Present **Professional Development in Teaching Provider** for Third Year **Graduate Student Lecturers (GSLs)**, *The University of Chicago Mathematics Department*

- Jointly with Sarah Ziesler
- Co-developed and led workshops on
  - *Backwards design of course*
  - *Handling unexpected classroom scenarios*
  - *Understanding cognitive demand*
  - *Designing exam questions*
  - *Interpreting student feedback*
  - *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 develop-

ment 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, the scholars, and the department

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 (Innovation Technology division). Built a Python application consolidating multiple numerical routines into a single standardized workflow for analyzing non-pneumatic tires
  Supervisees: Ussama Mustafa, Praneel Panchigar, Kevin Yuan
- **Summer 2021**: Client-funded project analyzing customer-behavior trends and halo effects for a regional grocery chain, using customer segmentation to design targeted sales programs
  Supervisees: Abigail Breitenbucher, Luke Pritchard, Maya Vasta, Kweku Yamoah

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

2020–2021 **Second Reader for Senior Independent Study**, *College of Wooster*
Served as committee member and reader for the following independent studies
- 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"

2018–2019 **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

Other Professional Service

Summer 2026 **Endorsement Reviewer, Calculus 2 Activity Collection**, *The POGIL Project*

- Reviewed 12 activities against the Endorsement Rubric (POGIL fidelity) and the collection against the UDL Endorsement Rubric (POGIL values), assigning endorsement rankings with written justification toward publication
- Completed a four-hour reviewer training and rating-calibration session, then served on two review panels and a closing debrief

2025–Present **Member, AIME Editorial Board**, *Mathematical Association of America*

- Review, suggest, and edit problems for the American Invitational Mathematics Examination (AIME), an intermediate examination in the selection process for the US International Mathematical Olympiad team

2024–Present | **Graduate Student Lecturer Observation**, *The University of Chicago*

- Formally observed an average of five GSLs and Phoenix GTAs per year, provided verbal feedback, and submitted written reports to the department
- In certain cases, provided a quarter-long teaching-support plan (six meetings, culminating in a written report)

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

2023–2024 | **Senior Personnel (Faculty)**, National Science Foundation IUSE Grant Proposal, *The University of Chicago*

- Collaborated with Britni Ratliff and Zsuzsanna Szaniszlo on an Improving Undergraduate STEM Education proposal, authoring the mathematics portion. Status: not funded

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

2015, 2019 | **Judge**, MAA Undergraduate Poster Session (*JMM 2019*, Baltimore, MD) and QED Young Math Symposium (*Math Circles of Chicago*)

2014 **Organizer & Moderator, AWM Postdoc Panel**, *The University of Chicago*

- Organized and moderated a panel of postdocs for graduate students on the academic job search and application process

Professional Membership

2023–Present **Member**, *Mathematical Association of America*

- Active member of Special Interest Group on Inquiry-Based Learning (**SIGMAA IBL**) since 2025
- Lifetime member since 2026

2014–2019 Member of the **American Mathematical Society**

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

Professional Development

2025–2026 **Associate Pedagogy Fellow**, *Chicago Center for Teaching and Learning*

- Affiliated with CCTL as an Associate Pedagogy Fellow, providing collegial mentorship for the Pedagogy Fellows cohort and fostering pedagogical discussion within the broader UChicago community
- Paired formative observation of a Chemistry colleague's lecture, applied in GSL observations and LJT coaching; fellowship discussions on generative AI applied in syllabus AI policies

2025–2026 **Project EMBER Coordination Community of Practice**, *Virtual*

- Monthly community of practice for mathematics course coordinators, facilitated by Deb Carney, Mary Pilgrim, and Chris Rasmussen; attended all six sessions on coordination roles, leadership, mentoring TAs, and coordinator support; the session on giving feedback on teaching applied in GSL observation and coaching, and the series in Math 130s sequence planning

Aug 2026 **MAA MathFest 2026**, Boston, MA

- Attended sessions and workshops on generative AI in undergraduate mathematics and on alternative grading implementations, alongside presenting in a contributed paper session (see Pedagogical Presentations)

Spring 2026 **SIGMAA IBL Virtual Workshop Series**, *Mathematical Association of America*

- Attended three sessions on inquiry-based lesson design and equity in IBL, including Jeff Ford's four-stage framework for sequencing guided-inquiry prompts, now used in tutorial problem sets alongside the POGIL learning cycle

March 2026 **Pearson Calculus Digital Leadership Forum and ICTCM 2026**, Houston, TX

- Invited to give pedagogical feedback on calculus courseware and AI-powered study tools; ICTCM 2026 sessions on AI in undergraduate mathematics and course redesign applied in Math 163 course design and the MAA virtual talk

Winter 2026 | **STEM Pedagogy Journal Club**, *Chicago Center for Teaching and Learning*

- Reading group for STEM instructors convened by Mac Crite; discussed Moon et al. (2021) on active-learning practices and exam performance and Pan et al. (2020) on learning from errors, applied in the peer-instruction cycle in tutorial problems and the multiple-attempt retesting structure in standards-based grading

Jan 2026 | **Joint Mathematics Meetings 2026**, Washington, D.C.

- Completed the MAA Professional Enhancement Program workshop *"Teaching and Learning Across Disciplines: What Mathematics Educators Can Learn from Engineering Education Scholarship"*, adopting the KEEN entrepreneurial-mindset framework into collaborative-learning task design, where it now structures the concept–procedure–concept loop in tutorial problem sets; TPSE and Project NExT sessions applied in GSL training and AI course design

2025–2026 | **Generative AI in Mathematics Teaching Community of Practice**, *Virtual*

- Online community of practice for college mathematics instructors using generative AI; discussions on AI-integrated course design, interactive materials, and AI-assisted assessment informed AI-assisted workflows for course design and assessment

Oct 2025 | **Collaborative Feedback Training (CFT)**, *POGIL Activity Clearinghouse (PAC), The POGIL Project*

- Completed the PAC Collaborative Feedback Training, using POGIL learning-cycle and process-skills rubrics to review and improve POGIL activities; prerequisite for submitting and reviewing Clearinghouse activities, and applied in revising CL tutorial problems

Aug 2025 | **MAA MathFest 2025**, Sacramento, CA

- Completed two MAA Minicourses, *"Introduction to Process Oriented Guided Inquiry Learning (POGIL) for Math and Stats Courses"* and *"Navigating the AI Landscape: Practical and Ethical Integration in Mathematics Education"*

2024–2025 | **Pedagogy Fellows Program**, *Chicago Center for Teaching and Learning*

- Selected as part of a competitive, year-long cohort of 15 faculty members
- Focused on the pedagogical redesign of the Collaborative Learning (CL) Junior Tutor training program syllabus
- Attended a series of structured workshops on key pedagogy 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

Nov 2024 | **RUME CMI Professional Growth Working Group**, *Virtual*

- Invited by the OPEN Math workshop organizers to a working group on professional development for college mathematics instructors and sustainable teaching-support structures; session used in planning the GSL professional-development series

July 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–Present | **Exploratory Teaching Groups (ETGs)**, *Chicago Center for Teaching and Learning*

- **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
  - Designed and presented in O-week bootcamps for undergraduate TAs facilitating the CL program
- **Participant**, *Implementation of UChicago Collaborative Learning* (2025–2026)
  - Focused on brainstorming pathways to expand the CL program to other departments such as Economics, Computer Science, and Physics

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
- Participation led to an invitation to the Project EMBER coordination community of practice

2023–Present | **Chicago Center for Teaching and Learning Programs**, *The University of Chicago*

- Attended the annual September Symposium for instructors (2023, 2024, 2025) and CCTL workshops and panels on interactive lecturing, generative AI, inclusive pedagogy, prior knowledge, and assessment
- Participated in lunchtime reading groups on *The Hidden Curriculum* (Gable), *The Art of Gathering* (Parker), and *Grading for Growth* (Clark and Talbert)
- Sessions on generative AI and student motivation applied in syllabus AI boundaries and open-question assignment design; *The Hidden Curriculum* applied in Phoenix STEM advising

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"* and *"Teaching At Its Best"*
- Presented several talks at the seminar (see Pedagogical Presentations)
- Served as a panel member and discussion facilitator on multiple occasions
- Concept maps adopted as a prerequisite for the Honors Calculus III oral final; question-design session applied in the Examples and Counterexamples standards; standards-based-grading-at-scale session applied in Math 130s implementation planning

2020–2023 | **Teaching and Assessment Workshops**, *College of Wooster*

- Annual STEM Success Initiative workshops on inclusive practices for teaching, grading, and assessment, and on supporting diverse students
- Assessment workshop (2021), organized by the Director of Educational Assessment (Academic Affairs), on setting course goals, writing fair assessment items, and selecting 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
- Applied in the transition to mastery-based grading in gateway courses and the Math 130s standards-based grading conversion

Research and Pedagogical Interests

Low-dimensional topological dynamics, particularly nonabelian group actions on the circle and extremal rotation numbers. Bounded cohomology, stable commutator length, and quasimorphisms on free groups. Formal languages and their application to problems in combinatorial and geometric group theory. Alongside this, active inquiry into undergraduate mathematics teaching, including collaborative learning, alternative grading, and the use of generative AI in course design and assessment.

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.

Pedagogical Presentations

National Conferences and Invited Talks

Aug 2026 | *"Alternative Grading in a Proof Course: Design Challenges from Honors Calculus"*, **MathFest - Contributed Paper Session on Lessons Learned from Alternative Grading Implementations**, *Mathematical Association of America* Boston, MA

Jun 2026 | *"Scaling POGIL-Informed Collaborative Learning in TA-Led Calculus Tutorials"*, **POGIL Practitioner Collaborative**, *The POGIL Project* *Virtual*

Jun 2026 | *"Mindset-Driven Task Design for Collaborative Learning in Calculus"*, **POGIL Practitioner Collaborative**, *The POGIL Project* *Virtual*

May 2026 | *"Teaching Your AI How You Teach"*, **MAA Virtual Programming, AI in the Classroom: What's Working (and What's Not)**, organized by the Subcommittee on Technology in Mathematics Education, *Mathematical Association of America* *Virtual*

Feb 2026 | *"Implementing Collaborative Learning through POGIL"* (invited), **Mathematics Instructor Lunch Series**, *Indiana University Bloomington* Bloomington, IN

Aug 2025 | *"Implementing Collaborative Learning through POGIL in High-Enrollment Calculus Tutorials"*, **MathFest**, *Mathematical Association of America* Sacramento, CA

Aug 2025 | *"Reflections from the Implementation of a Large-Scale SBG at UChicago"* (with Kale Davies; presented by Kale Davies), **MathFest**, *Mathematical Association of America* Sacramento, CA

Mar 2022 | *"Techniques Grading in an IBL-style Intro to Proofs Course"*, **Project NExT session on Re-Imagining Grading: The Whys and Hows**, *Joint Mathematical Meetings* *Virtual*

University of Chicago Seminars and Panels

Winter 2026 | *"Designing and Adapting Active Learning Activities for Service Math Courses"*, **Math Department Pedagogy Seminar**, *The University of Chicago* Chicago, IL

Nov 2025 | *"Core Conversations: How do we teach the Core in the era of generative AI?"* (invited panelist), **College Core Curriculum forum**, *University of Chicago* Chicago, IL

Feb 2025 | *"AI panel: on the use of AI in math classes"* (panelist), **Math Department Pedagogy Seminar**, *The University of Chicago* Chicago, IL

Oct 2024 | *"Understanding Intellectual Growth: Applying Perry's Scheme"*, **Math Department Pedagogy Seminar**, *The University of Chicago* Chicago, IL

May 2024 | *"Mastery-Based Grading"*, Presentation to College Fellows (with Kale Davies), **CCTL Workshop**, *The University of Chicago* Chicago, IL

Jan 2024 | *"Collaborative Learning in Undergraduate Mathematics"*, **Math Department Pedagogy Seminar**, *The University of Chicago* Chicago, IL

Research Presentations

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

Jan 2022 | **Ohio Speaker's Circuit**, *Kenyon College* OH

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

Apr 2018 | **American Mathematical Society Spring Southeastern Sectional Meeting**, *Vanderbilt University* Nashville, TN

Jan 2018 | **American Mathematical Society Special Session on Dynamical Systems: Smooth, Symbolic, and Measurable**, *Joint Mathematical Meetings* San Diego, CA

Sep 2017 | **American Mathematical Society Fall Eastern Sectional Meeting - Special Session on Geometric Group Theory**, *University at Buffalo* Buffalo, NY

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 | **Scissors 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

2025–2026 | **Associate Pedagogy Fellow**, *Chicago Center for Teaching and Learning*
- Professional development grant: $500

2024–2025 | **Pedagogy Fellow**, *Chicago Center for Teaching and Learning*
- Professional development grant: $1000

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 the Bachelor of Math program, 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

2007–2009 | **National merit scholarships and fellowships**, Government of India
- National Board of Higher Mathematics scholarship, *Department of Atomic Energy* (2009)
- Kishore Vaigyanik Protsahan Yojana fellowship, *Department of Science and Technology* (2008)
- National Talent Search Examination scholarship, *National Council of Education Research and Training* (2007)

Skills and Languages

Technical | C, Python, Octave, Mathematica, LaTeX, PreTeXt, HTML/CSS, Git/GitHub, Qualtrics, Gradescope, Moodle, Canvas

Language | English (fluent); Bengali (fluent); Hindi (fluent)