Denison University

Director of the Center for Learning and Teaching	2020 – present
Full Professor	2015 – present
Chair of Mathematics and Computer Science	2016 – 2018
The Nancy Eshelman Brickman Endowed Chair	2014 – 2019
Associate Professor	2008 – 2015

Highlights

- **Co-editor and contributing author** of The Encyclopedia of Knot Theory published December 29, 2020 by Chapman and Hall/CRC.

- **Creator and senior-editor** of Teaching Tidbits blog for the Mathematical Association of America (MAA) which provided techniques on evidence-based active teaching strategies for mathematics and STEM related fields. During its two-year run, the site had **over 100,000 unique visits**.

- Secured **over $500,000** in NSF funding including:

  - **Co-PI and Project Team coordinator** for the MAA Instructional Practices Guide Project – a guide to evidence-based instructional practices in undergraduate mathematics. The Guide had **over 20,000 unique downloads** as of January, 2020.
  - **Creator, co-organizer and host** of the Undergraduate Knot Theory Conference 2009, 2012, 2016, 2019. Each a was 3-day national conference with 95-110 participants ranging from undergraduates, graduate students, and undergraduate faculty, to leading researchers in the field. A total of 135 scholarly presentations.
  - **Creator** of NSF funded website Technically Speaking which trains STEM students how to give technical talks to a non-technical audience.

- Contracted by the American Mathematical Society to develop a hands-on activity in knot theory for the two-day USA Science and Engineering Festival in Washington, D.C. which drew **over 150,000 attendees**.

- **Conducted undergraduate research** with 11 students, resulting in five publications and over $1,500 in student awards for presentations at national Joint Mathematics Meetings and MathFest.

- Taken **over 400 Denison students** to a variety of regional/national STEM conferences, where students presented their work in STEM.

- Written 10 peer-reviewed publications and presented 15 invited presentations on **active-learning strategies in the STEM classroom**.

- 2012-2013 **Distinguished Teaching Award**, Ohio Section of the MAA.

- Secured $30,000 in funding the Denison 3-D Printer Maker Space and launched first-ever 3-D printing course at Denison for STEM students.

Refereed Research Publications *indicates undergraduate co-author

- Colin Adams (Editor), Erica Flapan (Editor), Allison Henrich (Editor), Louis H. Kauffman (Editor), Lewis D. Ludwig (Editor), *The Concise Encyclopedia of Knot Theory* published December 29, 2020 by Chapman and Hall/CRC. Authored Chapter 1 and 5.

- Ludwig, Lewis D.; Paat, Joseph S.; Lee, Hwa Jeong; Peiffer*, Amanda *Knot Mosaic Tabulation*, **11** (2018), no. 1, 13-26.

- Flapan, Erica et al., *From Molecules to the Universe: An Introduction to Topology*, American Mathematical Society (December 22, 2015). Coauthored Chapters 4 and 11.

- Ludwig, Lewis D.; Evans*, Erica L.; Paat*, Joseph S., An infinite family of knots whose mosaic number is realized in non-reduced projections, J. Knot Theory Ramifications **22** (2013) no. 7, 11 pp.

- Arbisi*, Pamela; Ludwig, Lewis D., *Linking in Straight-edge embeddings of K_7*, J. Knot Theory Ramifications, **19** (2010), no. 11, 1431-1447 .

- Ludwig, Lewis D.; Nyikos, Peter; John E. Porter, *Dowker Spaces Revisited*, Tsukuba J. Math **34** (2010), no. 1, 1-11.

- Foisy, Joel; Ludwig, Lewis D., *When graph theory meets knot theory. Communicating mathematics*, 67–85, Contemporary Mathematics **479** Amer. Math. Soc., Providence, RI, 2009.

- Liu, Chuan; Lin, Shou; Ludwig, Lewis D., *Spaces with a σ-point-discrete Weak Bases*, Tsukuba J. Math., **32** (2008), no.1, 165-177.

Refereed Pedagogical Publications

- Ludwig, Lewis D., *Why I learned the Rubik's Cube: Seeing the expert blindspot*, MAA Focus, April–May, 2022, 11–14.

- Ludwig, Lewis D., *The one question calculus final*, MAA Focus, Aug-Sep, 2019, 16–17.

- Ludwig, Lewis, D. *MAA Instructional Practices Guide* Project Leadership Team: Martha L. Abell, Linda Braddy, Doug Ensley, Lewis Ludwig, Hortensia Soto *Notes* (**89**) 2016, MAA Press.

- Ludwig, Lewis D.,"Introduction to Proofs Over-Easy: A Low-Cost Alternative to the Flipped Classroom." *Beyond Lecture: Techniques to Improve Proof-Student Writing Across the Curriculum* edited by Rachel Schwell, Aliza Steurer, and Jennifer F. Vasquez, *Notes* (**85**) 2016, MAA Press, 213-219.

- Higgins, Aparan; Ludwig, Lewis; Servatius, Brigitte, *Papers, posters, and presentations as outlets for undergraduate research*, Involve **7** (2014), no. 3, 327-333.

- Edwards, Annabel, Ludwig, Lewis D., *Diffusion and random walks*, peer reviewed education materials for mathematics and chemistry developed for the Capital University National Science Foundation grant (DUE 9952806): *Computational science across the curriculum.* Subcontract amount: $2,000. Award period March-December, 2011.

- Ludwig, Lewis D., Smith, Geoff R. *Using matrix algebra to understand population growth rate*, peer reviewed education materials for mathematics and ecology developed for the Capital University National Science Foundation grant (DUE 9952806): *Computational science across the curriculum.* Subcontract amount: $2,000. Award period March-December, 2011.

- Ludwig, Lewis D., *Discrete vs. continuous population models*, peer reviewed mathematical education materials developed for the Capital University National Science Foundation grant (DUE 9952806): *Computational science across the curriculum.* Subcontract amount: $5,000. Award period July-December, 2010.

- Ludwig, Lewis D., *Technically Speaking*, article for Resources for Undergraduate Research, December, 2010, MAA.org.

- *Technically speaking: Resource DVD*, a series of video vignettes that portrayed student-actors presenting a small portion of a mathematical talk, roughly 30-90 seconds in length. In each set of vignettes, the student would give two ways to present an idea: one with shortcomings, the second correcting these shortcomings. The main goal of the project was to improve the oral communication skills of undergraduate mathematics and related STEM (Science, Technology, Engineering, and Mathematics) students. Fully funded by the National Science Foundation Course, Curriculum and Laboratory Improvement grant (ID 0632804). Distributed 450 copies of the DVD to math departments and programs on three continents. Companion website at techspeaking.denison.edu, January, 2009.

- Havill, Jessen; Ludwig, Lewis D., *Technically speaking: Fostering the communication skills of computer science and mathematics students*, Proceedings of the Thirty-Eighth SIGCSE technical symposium on computer science education, 185–189, 2007.

Student Research

- Research Students:

Amanda Peiffer	2014	Rachel Grotheer (H,P,A)	2007
Chen Gary Wu	2012	Matt Steinke (H)	2007
Erica Evans (A,P)	2010	Pam Arbisi (H,P)	2006
Joe Paat (A,P)	2009, 2010	Evan Star	2006
Jacob Shapiro (A)	2009	Colleen Hughes (H,P,A)	2004
Sam Behrend (H,A)	2008		

Table 1: H: Honors Thesis, P:Publication, A: Award

- Hughes, Colleen, *Linked triangles in straight edge embeddings of K_6*, Pi Mu Epsilon Journal, **12** (2006), no. 4, 213–218. Winner of The 2006 Richard V. Andree Award for best student article published in 2006.

<u>Grants</u>

- Co-Principal Investigator for 2019 *National Science Foundation*, $45,890 award with Jennifer McLoud -Mann of the Washington University– Bothel, Allison Henrich of University of Washington, and Colin Adams of Williams College to host the *Undergraduate Knot Theory Conference IV* at Washington University– Bothel in July, 2019.

- Co-Principal Investigator for 2015 *National Science Foundation*, $39,350 award with Colin Adams of Williams College to host the *Undergraduate Knot Theory Conference III* at Denison University in July, 2016.

- Co-Principal Investigator for 2015 *National Science Foundation: Math EAGER*, $299,992 award with Linda Braddy of the MAA for the project *Guide to Evidenced-Based Instructional Practices in Undergraduate Mathematics* to develop a pedagogy guide for the Mathematical Association of America, September, 2015.

- Principal Investigator for 2015 *National Science Foundation*, $49,999 award with Diana White of University of Colorado to host the *Translating Education Research into Classroom Practice* workshop in Denver, CO October, 2015.

- Principal Investigator for 2012 *National Science Foundation*, $33,520 award with Colin Adams of Williams College to host the *Undergraduate Knot Theory Conference* at Denison University in July, 2012.

- Principal Investigator for 2009 *National Science Foundation*, $28,000 award with Colin Adams of Williams College to host the *Undergraduate Knot Theory Conference* at Denison University in July, 2009.

- Principal Investigator for 2007 *National Science Foundation: Course, Curriculum, and Laboratory Improvement Grant*, $72,746 for the project *Technically Speaking* to develop a series of instructional video vignettes which are freely available on the web. This project is rooted in the experiences of the oral communication component of the Math 210 Introduction to Proofs course at Denison.

- 2007 *Mellon Cluster Award: Inter-Institutional Initiatives*, $45,000 with colleagues from Furman University, Harvey Mudd College, and Vassar College to host the *The Art and Science of Teaching Mathematics*. A three day conference held at Harvey Mudd with over 30 participants from the cluster schools.

Contracted Workshops/Major Presentations

- *A knotty challenge*, contracted presentation/activity for attendees of Mo-Math – National Museum of Math, 2015 MOVES conference, New York, NY, July, 2015.

- *Mathematical research... it's not what you think!*, contracted presentation/activity for undergraduate students attending 2014 MathFest, Portland, OR, funded by the Mathematical Association of America, August, 2014.

- *Technically Speaking: preparing students to communicate technical information in a non-technical world*, invited workshop presenter for the Mathematical Association of America and Project NExT, Madison, WI. Fully funded by the MAA with stipend, August, 2012.

- *Mathematical research... it's knot what you think!*, contracted to develop hands-on activity in knot theory for the American Mathematical Society and present at the two-day USA Science and Engineering Festival in Washington, D.C. which drew over 150,000 attendees. Secured funding to include four Denison students: Nathan Zakahi ('12), Holly Wilson ('13), Janie Frandsen ('14), and Paul Yang ('15). Fully funded by the AMS with stipend, April, 2012.

- *Preparing students to communicate mathematics*, organized and presented a two-day mini-course with Michael Orrison, Harvey Mudd College, with 22 attendees, 2009 MathFest. Fully funded by the MAA with stipend, August, 2009.

Conferences Organized

- *2014 Spring Ohio MAA and the Great Lakes SIAM Sectional Meeting*, program chair for 2-day event held at the University of Toledo with nearly 130 attendees. Developed and organized program that included four national keynote speakers, and over 40 contributed talks. April, 2014.

- *2013 Fall Ohio MAA Sectional Meeting*, program chair for 2-day event held at Cleveland State University with nearly 100 attendees. Developed and organized program that included four national keynote speakers, and over 30 contributed talks. October, 2013.

- *2012 Spring Ohio MAA Sectional Meeting*, lead local-organizer for 2-day event held at Denison with over 200 attendees, five national keynote speakers, and over 40 contributed talks, mostly by undergraduates. April, 2013.

- *2012 Undergraduate Knot Theory Conference*, July 15-18, 2012 lead organizer and host. A 4-day national conference with 99 registrants ranging from undergraduates, graduate students, and undergraduate faculty.

- *Undergraduate Knot Theory Conference*, July 15-17, 2009 lead organizer and host. A 3-day national conference with over 110 participants ranging from undergraduates, graduate students, and undergraduate faculty, to leading researchers in the field. Over 50 scholarly presentations were delivered. In addition, organized the 2009 MAA *Summer Workshop on Knot Theory* presented by Colin Adams of Williams College.

Invited Research Presentations

- *Knot Mosaics: something for everyone,*invited speaker, Ohio MAA Fall, 2020.

- *Knot Mosaics: Open questions for everyone*, UnKnot Conference IV, Washington University – Bothell, Bothell, WA July, 2019.

- *Knot mosaics: something for everyone*, Invited Paper Session: Open and Accessible Problems in Undergraduate Research, 2017 Joint Math Meetings, Atlanta, GA January, 2017.

- *Computer algorithms for counting knot mosaics*, Invited Paper Session: Open and Accessible Problems in Knot Theory, 2016 MathFest, Columbus, OH, August, 2016.

- *Tabulating knot mosaics*, UnKnot Conference III, Denison University, Granville, OH, July, 2016.

- *Knot mosaics – recent results*, invited presentation in the special session "Knot theory and its applications" at the American Mathematical Society Sectional Meeting at University of North Carolina - Greensboro, November, 2014.

- *Knot mosaics: results and open questions*, Invited Paper Session: Open and Accessible Problems in Knot Theory, 2013 MathFest, Hartford, CT, August, 2013.

- *Knot mosaics: the mosaic numbers of an infinite family*, invited presentation at the conference on the Topology of Spatial Graphs at Loyola Marymount University, Los Angeles, CA, fully funded by the NSF, June, 2013.

- *Knot mosaics*, UnKnot Conference II, Denison University, Granville, OH, July, 2012.

- *Outlets for undergraduate research*, invited presentation at *2012 Trends in Undergraduate Research in Mathematical Sciences (TURMS)*, an invitation only event of the leading practitioners in undergraduate research in mathematical sciences, fully funded by the National Science Foundation and the National Security Agency, Chicago, IL, October, 2012.

- *When topology meets chemistry*, presentation of a chapter of our manuscript developed at Park City Math Institute, fully funded by the NSF, July, 2011.

- *Intrinsic linking and knotting in straight-edge embeddings of complete graphs*, International Workshop on Spatial Graphs 2010, Waseda University, Tokyo, Japan, fully funded by Japan Society for the Promotion of Science, August, 2010.

- *Links and knots in complete graphs with linear edges*, Invited Paper Session: Open and Accessible Problems in Knot Theory, 2009 MathFest, August, 2009.

- *Links and Knots in Straight-edge Spatial Graphs*, UnKnot Conference, Denison University, Granville, OH, July, 2009.

Invited Pedagogical Presentations

- *Two challenges in remote teaching*, Center for Learning Futures virtual colloquium, Ahmedabad University, Gujarat, India, November, 2020.

- *Fostering student engagement*, paper session Enhance Your Teaching through Best Practices That Align with the Instructional Practices Guide, 2019 MathFest, Cincinnati, OH, 2019.

- *Helping your students do their reading*, Summer Analysis Workshop, Oberlin College, May, 2016.

- *How you too can join the 3D printing craze!*, invited paper session What Can a Mathematician Do with a 3D Printer?, 2015 MathFest, Washington, D.C. August, 2015.

- *Reconsidering Hilbert's list, with a pedagogical twist*, invited address for Ohio Section Teaching Award recipient, 2014 Fall Section Meeting of the Ohio MAA, Wittenburg University, October, 2014.

- *The over-easy classroom*, invited panelist/presenter for the MAA Committee on the Teaching of Undergraduate Mathematics Panel Discussion Maximizing your impact in the classroom: Case studies in best practices for classroom teaching, 2014 Joint Mathematical Meetings, Baltimore, MD, January, 2014.

- *Developing the life skill of thinking mathematically*, invited paper session Offering Students Lessons Beyond Mathematics, Through Mathematics, 2011 MathFest, Lexington, KY, August, 2011.

- *Developing students mathematical (oral) language skills*, invited panel presentation for Project NExT, 2011 Joint Mathematical Meetings, New Orleans, LA, January, 2011.

- *Preparing students to communicate mathematics*, organized and presented during 80-minute panel discussions supported by the MAA CUPM Subcommittee on Research by Undergraduates - Project NExT Panel Discussion, with Joseph A. Gallian, University of Minnesota – Duluth, Darren Naryan, RIT, and Michael Orrison, Harvey Mudd College, Joint Mathematics Meetings, Washington D.C., January, 2009.

- *Technically speaking: Fostering the communication skills of computer science and mathematics students*, with Jessen Havill, Thirty-Eighth SIGCSE technical symposium on computer science education, Covington, KY, March 2007.

Student Research Awards

- Erica Evans '11, summer 2010, presented our findings at the national 2010 MathFest meeting in Pittsburgh, PA, and was 1 of 10 students to win an award ($150) for best presentation and result from 58 presentations at the Pi Mu Epsilon student session.

- Joe Paat '11, summer 2010, presented our findings at the national 2010 MathFest meeting in Pittsburgh, PA, and was 1 of 10 students to win an award ($150) for best presentation and result from 58 presentations at the Pi Mu Epsilon student session.

- Jacob Shapiro '10, summer 2010, presented our findings at the national 2010 MathFest meeting in Pittsburgh, PA, and was 1 of 20 students to win an award ($100) for best presentation and result from 150 presentations at the MAA student session.

- Joe Paat '11 and Jacob Shapiro '10, summer 2009, presented our findings at the 2010 JMM Undergraduate Poster Session in San Francisco and were 2 of 33 students to win an award (\$100) for best presentation and result from over 180 other poster presentations.

- Sam Behrend '09, summer 2008, presented our findings at the national 2008 MathFest meeting in Madison, WI, and was 1 of 8 students to win an award (\$150) for best presentation and result from 48 presentations at the Pi Mu Epsilon student session. Sam also was one of 33 students from 206 chosen for a similar award at the 2009 JMM Undergraduate Poster session in Washington, DC.

- Rachel Grotheer '08, summer 2007, presented our findings at the national 2007 MathFest meeting in San Jose and was 1 of 12 students to win an award (\$150) for best presentation and result from 75 presentations at the Pi Mu Epsilon student session. Rachel also was one of 34 students from 185 chosen for a similar award (\$100) at the 2008 JMM Undergraduate Poster session in San Diego.

Contributed Pedagogical Presentations

- *Student beliefs on math ability and sense of belonging to a math community*, (poster with Frank Hassebrock) at Integrating Cognitive Science with Innovative STEM Education, Northwestern University, September, 2015.

- *Lessons from a first-year learning community*, with Dr. Kim Specht, contributed presentation at the 2015 Ohio PKAL STEM Conference, Otterbein College, May, 2015.

- *The Over-easy Classroom*, contributed presentation at the 2014 MathFest, Portland, OR, August, 2014.

- *Test Tuesday*, contributed presentation for the session on Active Learning at the 2014 MathFest, Portland, OR, August, 2014.

- *S*TEM LLC: Lessons from a First-Year Learning Community with Kim Specht, presenting our findings from our two-year STEM-LLC pilot learning community, Denison Scientific Association, April, 2014.

- *The art of mathematical thinking*, session on First Year Study Courses, 2010 MathFest Pittsburgh, PA, Capital University, August, 2010.

- *Preparing students to orally communicate technical information*, session on Effective Practices for Teaching Mathematical Communication Skills, 2010 MathFest Pittsburgh, PA, Capital University, August, 2010.

- *Preparing students in the art of oral communication*, 2008 Fall Ohio MAA Section Meeting, Capital University, October, 2008.

- *Technically speaking: fostering the communication skills of CS and Math students*, 2007 Fall Ohio MAA Section Meeting, Wittenberg University, October, 2007.

- *Fostering the communication skills of mathematics students*, 2007 Math-Fest, San Jose, CA, August, 2007.

Teaching Awards

- *Nancy Eshelman Brickman Endowed Professor*, named chair of the faculty at Denison University.

- *Distinguished Teaching Award*, the Ohio Section of the Mathematical Association of America.

- ExxonMobil Project NExT Fellow 2001

- University College Graduate Associate Outstanding Teaching Award 2000, Ohio University

- Outstanding Teaching Assistant, Ohio University 1998

- Outstanding Teaching Assistant, Miami University 1996

Leadership in the Mathematical Community

- Ohio MAA Programming Committee chair, 2013-2014.

- Reviewer for the American Mathematical Society MathSciNet, the leading mathematical research database in the US.

- Reviewer for Zentralblatt MATH, the most comprehensive reviewing service in mathematics, which provides reviews of peer-reviewed published articles and books in all fields of mathematics.

- External evaluator for three tenure cases and two cases of promotion to full professor.

- External reviewer for the Mathematics Department at Marietta College, April, 2010.

- National MAA Committee member on Teaching of Undergraduate Mathematics, 2009–2015.

- National counselor in mathematics and computer science for the Council for Undergraduate Research, 2007-2015.

- Ohio MAA Programming Committee member, 2011-2013.

- Reviewer, Posters on the Hill for the Council on Undergraduate Research, 2009-2011.

- Ohio MAA Committee chair on Section Activities, 2007-2011.

- Reviewer, NSF CCLI proposals Phase I 2008, CCLI proposals Phase II 2009, and S-STEM 2010.

- Referee for research journal Topology and Its Applications, 2004, 2005, 2008.

- Guest editor for *Topology Proceedings* **30** (2006), no. 2 which contains 16 refereed research articles from 3 major categories on general Topology.

Contact

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Education

Ohio University   Athens, Ohio
Ph.D. in Mathematics   March 2001
Thesis title:"Topological separation axioms: α-normal and β-normal"
Thesis supervisor: Alexander V. Arhangel'skii

Miami University   Oxford, Ohio
Masters of Science in Mathematics   May 1995

College of Mount St. Joseph   Cincinnati, Ohio
Masters of Education   August 1995

Bachelor of Arts in Mathematics   May 1993

Bachelor of Science in Computer   May 1991
Information and Business Administration

Employment

- **Denison University**   Granville, Ohio
  Director of the Center for Learning and Teaching   August 2020– present
  Chair of Mathematics and Computer Science   2016–2018
  Professor   September, 2015 – present
  Associate Professor   September 2008 – 2015
  Assistant Professor   September 2002 – 2008

- **Kenyon College**   Gambier, Ohio
  Visiting Assistant Professor   August 2001 – May 2002

- **Miami University**   Oxford, Ohio
  Visiting Professor   August 2000 – May 2001

- **Ohio University**   Athens, Ohio
  Graduate Teaching Fellow   September 1996 – July 2000

- **North College Hill High School**   Cincinnati, Ohio
  Mathematics Teacher   August 1995 – June 1996

- **Miami University**   Oxford, Ohio
  Graduate Teaching Assistant   August 1993 – May 1995