Elizabeth Roan

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EDUCATION

Doctor in Philosophy in Mathematics Education May 2024
Texas State University, San Marcos, TX
Graduate Mathematics Course Work (27 credit hours)
Dissertation: "Explaining the Mathematical Expressions Undergraduate STEM Majors Construct to Model Dynamic Scenarios"
Advisor: Dr. Jennifer A. Czocher

Bachelor of Science in Pure Mathematics May 2018
University of Arkansas, Fayetteville, AR

RESEARCH EXPERIENCE

Postdoctoral Research Fellow August 2025
Department of Mathematics
San Marcos, TX
Supervisor: Kate Melhuish

Postdoctoral Research Fellow July 2024 – July 2025
Department of Curriculum and Instruction
Indiana University Bloomington, IN
Supervisor: Erik Jacobson
Project Title: Attributions of Mathematical Excellence in Teaching and Learning

- Monitored project activities and database across four institutions
- Conducted and analyzed focus group data to gather validity evidence for an instrument to measure teachers' beliefs
- Conducted and analyzed semi-structured interviews with k-16 teachers regarding their beliefs about the cause of achievements gaps in mathematics education
- Mentored two graduate researchers in qualitative methods

Doctoral Research Assistant August 2019 - May 2024
Department of Mathematics
Texas State University San Marcos, TX
Supervisor: Jennifer A. Czocher
Project Title: Scaffolding Strategies for Undergraduate Mathematical Modeling Skills

- Developed a multiple-choice instrument for measuring undergraduate students modeling competencies

- Conducted 10 one-hour cognitive task-based interviews with 23 undergraduate students working on mathematical modeling tasks
- Curated data corpus using video editing software
- Analyzed video data using deductive and inductive qualitative coding methods along with mixed methodologies to make claims about the relationships between two different qualitative codebooks

TEACHING EXPERIENCE

Teacher of Record

Department of Mathematics, Texas State University

- Calculus for Life Science 1 (Fall 2025)
- Principles of Mathematics 1 (Fall 2025)
- Calculus for Life Science 1 (Fall 2023)

Instructional Assistant

Department of Mathematics, Texas State University

- Calculus 1 (Fall 2019)
- Elementary Algebra (SP 2019)
- Calculus 2 (SP 2019)
- Pre-Calculus (Fall 2018)

Summer Camp Teacher

MathWorks Junior Summer Math Camp, Texas State University

- Co-taught a two-week mathematics summer program for middle school students in summer 2019.

AWARDS AND HONORS

Outstanding Dissertation Award in the Social Sciences, Texas State University 2024
Graduate Research Excellence Award, Texas State University 2023
Graduate Research Excellence Award, Texas State University 2021
Graduate Teaching Excellence Award, Texas State University 2019

FUNDING

Rising Scholarly Travel Activity and Research Grant 2024
Award Total: $450.00
Texas State University

Doctoral Retention Fellowship 2023, 2024
Award Total: $6,432.48
Texas State University

Doctoral Research Fellowship 2022
Award Total: $4,976.07
Texas State University

Ross and Sarah Wayment Endowed Fund for Mathematics Education 2020, 2021

Award Total: $900
Texas State University

PUBLICATIONS: Peer Reviewed Journal Publications

Czocher, J.A., White, A., Kularajan, S., Roan, E., Baas, A. (in press). Quantizing and Visualizing the Influence of Scaffolding Moves on Mathematical Modeling Competencies. *Mixed Methods in Mathematics Education*, special issue of *Methods in Psychology***.**

Roan, E., Kularajan, S., Czocher, J.A. (2025). Task Classification Systems for Situations That Can Be Modelled with Multiplication *ZDM: Mathematics Education.* https://doi.org/10.1007/s11858-025-01657-4

Kularajan, S., Czocher, J.A., **Roan, E**. (2024). Quantitative Operators as an Analytical Tool for Explaining STEM Undergraduates' Construction of New Quantities During Modeling. *The Journal of Mathematical Behavior. 76*, 101198. https://doi.org/10.1016/j.jmathb.2024.101198

Roan, E., & Czocher, J. A. (2024). Instructors' beliefs and practices regarding mathematical modelling at the periphery of STEM. *International Journal of Mathematical Education in Science and Technology*, 1-29. https://doi.org/10.1080/0020739X.2024.2309268

Czocher, J., **Roan, E**., & Kularajan, S. S. (2024). Scaffolding Moves for Constructing Cognitively Meaningful Models of a Predator-Prey Scenario. PRIMUS, 34(6), 638–652. https://doi.org/10.1080/10511970.2024.2335476

Czocher, J. A., **Roan, E**., Quansah, A., & Baas, A. (2023). Calculus is the study of change, but differential equations students need help quantifying it. *International Journal of Mathematical Education in Science and Technology*, *55*(2), 574-584. https://doi.org/10.1080/0020739X.2023.2255205

Czocher, J. A., Melhuish, K., & Kandasamy, S., & **Roan, E**. (2021). Dual measures of mathematical modeling for engineers and other STEM undergraduates. *International Journal of Research in Undergraduate Mathematics Education*, 1-27. https://doi.org/10.1007/s40753-020-00124-7

PUBLICATIONS: Book Chapters

Roan, E. Czocher, J.A. (2024). *Reasoning students employed when mathematizing during a predator-prey modeling task*. In: Siller, HS., Geiger, V., Kaiser, G. (eds) *Researching Mathematical Modelling Education in Disruptive Times.* International Perspectives on the Teaching and Learning of Mathematical Modelling. Springer, Cham. https://doi.org/10.1007/978-3-031-53322-8_37

Czocher, J. A., Kularajan, S. S., **Roan, E**., & Sigley, R. (2023). Validating a Multiple-Choice Modelling Competencies Assessment. In G. Greefrath, S. Carreira, & G. A. Stillman (Eds.), *Advancing and Consolidating Mathematical Modelling: Research from ICME-*

14 (pp. 161-176). Springer International Publishing. https://doi.org/10.1007/978-3-031-27115-1_10

PUBLICATIONS: Manuscripts Under Review

Roan, E., & Czocher, J.A. (under review) Cognitive Reasons for Students Difficulties while Mathematizing Dynamic Scenarios. *Mathematical Thinking and Learning.*

Czocher, J.A., Baas, A., **Roan, E**., Quansha, A. (under review). A Theoretical Framework and Accompanying Measurement Approach for Mathematizing. *Journal for Research in Mathematics Education.*

Czocher, J.A., White, A., Baas, A., **Roan, E**., Kularajan, S. (under review). Inspecting and Vetting a Scaffolding Moves for Mathematical Modelling Framework. *Curriculum and Instruction*.

Czocher, J.A., White, A., Baas, A., **Roan, E**., Kularajan, S. (under review). Investigating the Uptake of Scaffolding Moves during Mathematical Modeling. *Journal of the Learning Sciences*.

PUBLICATIONS: Manuscripts in Progress

Roan, E., & Czocher, J.A. (in progress) Towards a Unified Theory of Mathematizing: Weaving together Quantitative Reasoning and Symbolic Blending.

Roan, E., Brand, L., Smith, B., Jacobson, E. (in progress) (Pre)Calculus Instructors Attributions of Mathematical Excellence. *Instructors. International Journal of Research in Undergraduate Mathematics Education.*

Roan, E., Jacobson, E.D., Gustaveson, A., Yavuz, S., & Jessup, N. (in progress) Alignment between Attributions of Mathematical Excellence and Attribution Theory. *Educational Psychologist*

PUBLICATIONS: Peer Reviewed Conference Proceedings

Roan, E., Brand, K., Gustaveson, A., Cross Francis, D., Smith, B., Franklin, J., Jacobson, E. (accepted). Exploring Teacher's Attribution Beliefs: Unpacking the Complexities of Mathematical Success and Struggle. *Proceedings of the forty-seventh annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. State College, PA.

Roan, E,. Brand, K., Jacobson, E. (in press). Attributions of Mathematical Excellence from the Perspective of (Pre)Calculus Instructors. *Proceedings of the 27th Annual Conference on Research in Undergraduate Mathematics Education*. Alexandria, VA.

Roan, E., & Czocher, J.A. (in press). Symbolic Forms for Inverse Relationships? Calling for Clarification on the Construct. *Proceedings of the 27th Annual Conference on Research in Undergraduate Mathematics Education*. Alexandria, VA.

Roan, E., & Czocher, J.A. (2024). The Cognitive Obstacles Associated with Structuring for Mathematization Undergraduates Encountered During Dynamic Modeling Tasks. *Proceedings of the 26th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE.

Kularajan, S. **Roan, E**., Czocher, J.A. (2023) Quantitative Operators in Mathematical Modeling. *Proceedings of the forty-fifth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Reno, NV.

Roan, E., Czocher, J.A. (2023) A Local Causal Explanation for Why Students Might Conflate Rates of Change and Amounts of Change. *Proceedings of the forty-fifth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Reno, NV.

Czocher, J.A., Baas, A., **Roan, E**., Quansha, A. (2023). Mutability of STEM Majors' Abstracted Quantitative Structures. *Proceedings of the forty-fifth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Reno, NV.

Roan, E., & Czocher, J.A. (2023). Reasoning students employed when mathematizing during a disease transmission modeling task. *Paper submitted to the 25th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE.

Czocher, J.A., **Roan, E**., Kularajan, S. (2023). Quantitative reasoning augments scaffolding for mathematical model construction. *Paper submitted to the 25th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE.

Roan, E., & Czocher, J.A. (2022). Justifications Students Use When Writing an Equation During a Modeling Task. *Proceedings of the forty-fourth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Nashville, TN.

Roan, E., & Czocher, J.A. (2022). Describing the Mathematical Models Undergraduate STEM Majors Construct During Modeling Tasks. *Proceedings of the forty-fourth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Nashville, TN.

Roan, E., & Czocher, J.A.. (2022). Instructor Beliefs and Practices at the Periphery of STEM. Karunakaran, S.S., & Higgins, A. (Eds.). *Proceedings of the 24th Annual Conference on Research in Undergraduate Mathematics Education*. (pp. 463 – 469). Boston, MA.

Roan, E., & Czocher, J.A.. (2022).Towards an Operationalization of Mathematization. Karunakaran, S.S., & Higgins, A. (Eds.). *Proceedings of the 24th Annual Conference on Research in Undergraduate Mathematics Education*. (pp. 1268). Boston, MA.

Czocher, J.A., Sigley, R., Kularajan, S., **Roan, E**. (2022). Analysis of a Mathematical Modeling Assessment. Karunakaran, S.S., & Higgins, A. (Eds.). *Proceedings of the*

24th Annual Conference on Research in Undergraduate Mathematics Education. (pp. 152 – 159). Boston, MA.

Czocher, J.A., **Roan, E**., Acevedo, C., Swartz, M., (2021). The Interface of Quantification and Covariational Reasoning in Real-World Scenarios. Olanoff, D., Johnson, K., Spitzer, S.M (Eds.) *Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*.(pp. 608-612). Philadelphia, PA.

Roan, E., & Czocher, J. A. (2021). *Students' Expected Gains From A Modeling Competition*. Paper presented at the 14th International Congress on Mathematics Education, Shanghai, China. July, 2021.

Czocher, J. A., Kandasamy, S. S., & **Roan, E**. (2021). *Validating a Modelling Competencies Assessment*. Paper presented at the 14th International Congress on Mathematics Education, Shanghai, China. July, 2021.

Roan, E., & Czocher, J.A. (2020). Mathematical modeling competitions from the participants perspective. *Proceedings of the 23th Annual Conference on Research in Undergraduate Mathematics Education*. (pp. 1111 – 1116). Boston, MA.

Czocher, J. A., Kandasamy, S., & **Roan, E**. (2020). Design and validation of two measures: competence and self-efficacy in mathematical modeling. Sacristán, A.I., Cortés-Zavala, J.C. & Ruiz-Arias, P.M. (Eds.). *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education,* (pp. 2308-2311). Mexico.

PRESENTATIONS: Invited Talks and Conference Presentations

Invited Talks:

Roan, E. (2025). Calculus is the study of change, but students need help quantifying it. Indiana University Mathematics Department Instructor Lunch, Bloomington, IN.

Roan, E. (2022). Reasoning students employed when mathematizing during a predator-prey modeling task. Oklahama – Texas Regional Conference in Research for Undergraduate Mathematics Education, Stillwater, OK.

Roan, E. (2021). Faculty Development Programs. SIMIODE Expo, Online.

Peer Reviewed Conference Presentations:

Czocher, J.A., Kularajan, S.K., **Roan, E.** (accepted). Can we use modeling cycles to predict which instructor scaffolding moves elicit specific modeling processes? International Conference on the Teaching of Mathematical Modeling and Applications, Linköping, Sweden, August 2025.

Roan, E., & Jacobson, E. (2025). Leveraging Attribution Theory to Inform the Repair and Remedy of Teachers' Attributions of Mathematical Excellence. *Proceedings of the Annual Meeting of the American Educational Research Association*. Denver, CO.

Roan, E. Czocher, J.A. (2022). *Reasoning students employed when mathematizing during a predator-prey modeling task.* International Conference on the Teaching of Mathematical Modeling and Applications, Wurzburg, Bavaria, Germany: Virtual Conference, September 2022.

PROFESSIONAL DEVELOPMENT

Teaching Workshops:

Fostering and Assessing Mathematical Communication Skills in Introductory-Level Courses
Summer 2025

- Online workshop run by the NSF funded OPEN Math project in conjunction with the Mathematics Association of America
- Learned to design assessments and rubrics that foster written and oral mathematical communication skills

Effective Assessment Strategies for Large Undergraduate Courses
Spring 2025

- In person workshop run by the Center for Incorporating Research Teaching and Learning at Indiana University
- Learned effective assessment strategies for large classes sizes

PATHWAYS Curriculum Workshop
Fall 2023

- Attended a two-day workshop for a pre-calculus research-based curricula
- Learned techniques for teaching pre-calculus via quantitative and covariational reasoning

Writing Workshops:

What Successful Proposal Writers Know: Clearing Common Hurdles to Research Grant Funding
Fall 2024, SP 2025

- A one-day workshop run by Elisabeth Andrews in conjunction with Indiana University's Proposal Development Services
- Develop skills in describing long-term project goals, meeting funder concerns about roadblocks, and convincing reviewers outside of your field of your projects merit

Scholarly Writing Program Workshops

- A series of workshops run by Indiana University's Scholarly Writing Program
- Develop skills in writing compelling abstracts, introductions, sentences, and arguments
- Titles of workshops:
    - Crafting a Compelling Argument (SP 2025)
    - Crafting a Compelling Abstract (Fall 2024)

- Crafting a Compelling Introduction (Fall 2024)
- Crafting Compelling Sentences & Paragraphs (Fall 2024)

PME-NA Doctoral Consortium
Fall 2022

- A pre-conference selective workshop designed to support the development of emerging scholars
- Developed skills in presenting ideas from dissertation

Research Methodology Workshops:

Quantitative Tools for Qualitative Data Analysis: A Truly Equal Status Data Science Design for Transparency, Rigorosity, and StoryTelling
Summer 2025

- A one-day workshop that is part of the Virtual Research Learning Series hosted by the American Education Research Association (AERA)
- Learned to classify long form and short form qualitative data using machine learning and natural language processing tools to articulate the structure of qualitative data

SERVICE

Professional Service:

Journal Reviewer

- Nordic Studies in Mathematics Education
- International Journal of Research in Undergraduate Mathematics Education
- The Mathematics Educator

Conference Reviewer

- North American Chapter of the Psychology of Mathematics Education Group
- SIG-MAA on Research in Undergraduate Mathematics Education

Institutional Service:

Mentor for SUPER in Math 2021-2023
Graduate Student Organization Texas State University

Undergraduate Instructional Assistant Co-Coordinator 2021
Department of Mathematics Texas State University

Graduate Welcoming Committee 2021
Department of Mathematics Texas State University

Graduate Student Panelist, Texas State University, San Marcos, TX 2019
Department of Mathematics Texas State University

Community Service:

FIRST Lego League Challenge Project Judge 2015-2020

PROFESSIONAL MEMBERSHIPS

American Educational Research Association

- Research in Mathematics Education Special Interest Group
- Constructivist Theory, Research and Practice Special Interest Group

Mathematics Association of America

PROFESSIONAL REFERENCES

Dr. Jennifer Czocher
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Texas State University
Elliot B301 601 University Drive, San Marcos, TX 78666

Dr. Erik Jacobson
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Associate Professor
Indiana University
201 N. Rose Avenue Wright Education Building, 3058 Bloomington, IN 47405

Dr. Dionne Cross Francis
dicross@unc.edu
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Associate Professor
University of North Carolina
CB 3500 Peabody Hall, Chapel Hill, NC 27599-3500