
Estrella Johnson
Associate Professor, Department of Mathematics
Assistant Dean for Inclusion and Diversity, College of Science
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(Last updated Nov. 2021)

Education

Portland State University, PhD in Mathematics Education, May 2013
Portland State University, Master's in the Science of Teaching Mathematics, August 2009
New Mexico State University, Bachelor's of Science in Secondary Mathematics Education, May 2007

Professional Positions

2021 – present, Assistant Dean for Inclusion and Diversity, College of Science, Virginia Tech, Blacksburg, VA
2020 – 2021, Director of Inclusion and Diversity, College of Science, Virginia Tech, Blacksburg, VA
2020 – present, Associate Professor, Department of Mathematics, Virginia Tech, Blacksburg, VA
2013 – 2020, Assistant Professor, Department of Mathematics, Virginia Tech, Blacksburg, VA

External Grants

Current

Principal Investigator for a \$129,315 NSF ISUE grant, “*Collaborative Research: Evaluating the Uptake of Research-Based Instructional Strategies in Undergraduate Chemistry, Mathematics, and Physics.*” NSF Award #1726281; Sept 2018 – Aug 2022 (Total collaborative award amount \$1,178,834; NSF Awards #1726318, #1726379, #1726042, #1726126, #1726281)

Under Review

Principal Investigator for a William T Grant proposal “*Assessing Collegiate Mathematics for Equity*”, Submitted Nov 2021.

Previous

Senior Personnel for a \$1,341,181 NSF IUSE grant, “*Progressing Through Calculus.*” NSF Award #1430540; Jan 2015 – June 2021
Principal Investigator at the lead institution for a \$297,271 NSF IUSE grant, “*Collaborative Research: Teaching Inquiry-Oriented Mathematics: Establishing Supports.*” NSF Award #1431595; Aug 2014 – July 2018 (Total collaborative award amount: \$1,188,984; NFS Awards: #1431595, #1431641, #1431393)
Consultant (and former graduate research assistant) for a \$2,367,889 NSF REESE grant, “*Characteristics of Successful Programs in College Calculus.*” NSF Award # 0910240; Aug 2008 - Dec 2014
Graduate Research Assistant on NSF Funded (CCLI) Project: *Teaching Abstract Algebra for Understanding*. I collected classroom video data, analyzed classroom mathematical activity, managed an undergraduate research team, supported mathematicians in implementing a research-

based curriculum (Inquiry Oriented Abstract Algebra), and investigated the challenges and opportunities of mathematicians as they engaged with the curriculum.

Publications

Refereed Journal Publications

- Chowdhury, A., Mullins, S.B., & Johnson, E. (In Press) Context matters: Understanding the relationship between instructor's beliefs and the amount of time spent lecturing. *International Journal for Research in Undergraduate Mathematics Education*, Accepted for Publication on Oct 8, 2021
- Reinholtz, D., Johnson, E., Andrews-Larson, C., Stone-Johnstone, A., Smith, J., Mullins, S.B., Fortune, N., Keene, K., Shah, N. (In Press) When active learning is inequitable: Women's participation predicts gender inequities in mathematical performance. *Journal for Research in Mathematics Education*. Accepted for Publication on Aug 9, 2021
- Rupnow, R., Hegg, M., Fukawa-Connelly, T., Johnson, E., & Weber, K. (2021) How mathematicians assign homework problems in abstract algebra courses. *Journal for Mathematical Behavior*, 64: <https://doi.org/10.1016/j.jmathb.2021.100914>
- Apkarian N., Henderson C., Stains M., Raker J., Johnson E, Dancy, M. (2021) What really impacts the use of active learning in undergraduate STEM education? Results from a national survey of chemistry, mathematics, and physics instructors. *PLOS ONE* ,16(2): e0247544. <https://doi.org/10.1371/journal.pone.0247544>
- Andrews-Larson, C., Johnson, E., Peterson, V., & Keller, R. (2021). Doing math with mathematicians to support pedagogical reasoning about inquiry-oriented instruction. *Journal of Mathematics Teacher Education*. 24, 127-154
- Johnson, E., Andrews-Larson, C., Keene, K., Keller, R., Fortune, N., & Melhuish, K. (2020). Inquiry and inequity in the undergraduate mathematics classroom. *Journal for Research in Mathematics Education*. 51(4), 504-516.
- Kuster, G., Johnson, E., Rupnow, R., & Wilhelm, A. (2019). The Inquiry-Oriented Instructional Measure. *International Journal for Research in Undergraduate Mathematics Education*. 5(2). 181-204.
- Johnson, E., Keller, R., Peterson, V., & Fukawa-Connelly, T. (2019). Individual and situational factors influencing pedagogical practice. *International Journal of STEM Education*. 6, Article number 23.
- Rasmussen, C., Apkarian, N., Hagman, J., Johnson, E., Larsen, S., & Bressoud, D. (2019). Characteristics of Precalculus through Calculus 2 programs: Insights from a national census survey. *Journal for Research in Mathematics Education*. 50(1), 98-112.
- Keller, R., & Johnson, E. (2019). Effects of individual and situational characteristics on the use of student-centered pedagogy in Calculus I. *International Journal for Teaching and Learning in Higher Education*. 31(1). 115-127.
- Johnson, E., Keller, R. & Fukawa-Connelly, T. (2018). Results from a national survey of abstract algebra instructors: Understanding the choice to (not) lecture. *International Journal for Research in Undergraduate Mathematics Education*. 4(2), 254-285.
- Kuster, G., Johnson, E., Keene, K., & Andrews-Larson, C. (2018). Inquiry-oriented instruction: A conceptualization of the instructional components and practices. *Problems, Resources, and Issues in Mathematics Undergraduate Studies*, 28(1), 13-30.
- Keller, R., Johnson, E., & DeShong, S. (2017). A structural equation model looking at student's participatory behavior and their success in Calculus I. *International Journal of STEM Education*. 4(1), 24.

- Hagman, J., Johnson, E., & Fosdick, B. (2017). Feeling the squeeze: Factors contributing to experiencing a lack of time in college calculus. *International Journal of STEM Education*. 4(1), 12.
- Johnson, E., Ellis, J., Rasmussen, C. (2016), It's about time: The relationships between coverage and instructional practices in college calculus. *International Journal for Mathematical Education in Science and Technology*, 47(4), 491-504.
- Johnson, E. (2013). Teacher's mathematical activity in inquiry-oriented instruction. *Journal of Mathematical Behavior*. 32(4), 761-775.
- Johnson, E., Caughman, J., Fredericks, J., & Gibson, L. (2013). Implementing inquiry-oriented curriculum: From the mathematicians' perspective. *Journal of Mathematical Behavior*. 32(4), 743-760.
- Larsen, S., Johnson, E., & Bartlo, J. (2013). Designing and scaling up an innovation in abstract algebra. *Journal of Mathematical Behavior*. 32(4), 693-711.
- Lockwood E., Johnson, E., & Larsen S. (2013). Developing instructor support materials for an inquiry-oriented curriculum. *Journal of Mathematical Behavior*. 32(4), 776-790.
- Johnson, E. M. S., & Larsen, S. (2012). Teacher listening: The role of knowledge of content and students. *Journal of Mathematical Behavior*, 31(1), 117-129.

Edited Chapters and Publications

- Johnson, E. (2019). Chapter 6. Undergraduate mathematics instruction: Not as bad as you'd think? S. Laursen & B. Ruedi (Eds.), *Lever for change: An assessment of progress on changing STEM instruction*. American Association for the Advancement of Science. Washington, DC.
- Fukawa-Connelly, T., Johnson, E., & Keller, R. (2016). Can math education research improve the teaching of abstract algebra? *Notices of the AMS* 63(3).
- Johnson, E. (2016). What is in Calculus I? *MAA FOCUS*, 36(2). 17-20.
- Johnson, E. & Hanson, K. (2015). Chapter 6: Academic and Social Supports. D. Bressoud, C. Rasmussen, & V. Mesa (Eds.), *Insights and Recommendations from the MAA National Study of Calculus*, Mathematical Association of America. Washington, DC.

Editorships

- Larsen, S., Johnson, E., Weber, K. (Eds). (2013). The Teaching Abstract Algebra for Understanding Project: Designing and Scaling up a Curriculum Innovation. *Journal of Mathematical Behavior*, 32(4)

Manuscripts Under Review

- Sanchez Robayo, B., Apkarian, N. Johnson, E., Alzaga Elizondo, T., Ellis, B., & Robbins, C. (accepted, pending book acceptance). Chapter 6. Institutional and Departmental Change: Responding to Crisis. E. Johnson, N. Apkarian, K. Vroom, A. Martinez, C. Rasmussen, & D. Bressoud, D. (Eds) *Addressing Challenges to the Precalculus to Calculus II Sequence through Case Studies*. Mathematical Association of America. Washington, DC.
- Yik, B.J., Raker, J., Apkarian, N., Stains, M., Henderson, C., Dancy, M., & Johnson. E. (Under Review). Evaluating the impact of malleable factors on percent time lecturing in gateway chemistry, mathematics, and physics courses. *Submitted to the International Journal of STEM Education*.
- Johnson, E., Apkarian, N., Vroom, K., Martinez, A., Rasmussen, C., & Bressoud, D. (Eds). (Under Review). *Addressing Challenges to the Precalculus to Calculus II Sequence through Case Studies*. Mathematical Association of America. Washington, DC.

Refereed Conference Proceedings (Selected)

- Moore, A. S., & Johnson, E. (2021). Borders, gender, and performative contradictions in active learning. In D. Kollosche (Ed.), *Exploring new ways to connect: Proceedings of the Eleventh International Mathematics Education and Society Conference*, Vol. 1 (pp. 203–206). Tredition. <https://www.mescommunity.info/proceedings/MES11.pdf>
- Alzaga Elizondo, T., Ellis, B., Apkarian, N., Sanchez-Robayo, B., Robbins, C., & Johnson, E. (2020). Departmental Change in Reaction to the Threat of Losing Calculus: Three Cases. In S.S. Karunakaran, Z. Reed, and A. Higgins *Proceedings of the 23rd Annual Conference on Research in Undergraduate Mathematics Education* (p. 151-158). Boston, MA.
- Apkarian, N., Johnson, E., Raker, J., Stains, M., Henderson, C., & Dancy, M. (2020) Assessing the Uptake of Research Based Instructional Strategies by Postsecondary Mathematics Instructors. In S.S. Karunakaran, Z. Reed, and A. Higgins *Proceedings of the 23rd Annual Conference on Research in Undergraduate Mathematics Education* (p. 18-27). Boston, MA.
- Fukawa-Connelly, T., Johnson, E., Hegg, M., Weber, K., & Rupnow, R.L. (2020) How Mathematicians Assign Homework Problems in Advanced Mathematics Courses. In S.S. Karunakaran, Z. Reed, and A. Higgins *Proceedings of the 23rd Annual Conference on Research in Undergraduate Mathematics Education* (p. 1053 -1059). Boston, MA.
- Keller, R., Johnson, E., Keene, K., Andrews-Larsen, C., & Fortune, N. (2020). For Women in Lecture, How They Feel Matters – A Lot Keller. In S.S. Karunakaran, Z. Reed, and A. Higgins *Proceedings of the 23rd Annual Conference on Research in Undergraduate Mathematics Education* (p. 1093-1098). Boston, MA.
- Mullins, S.B., Serbin, K., & Johnson, E. (2020). Relational Interactions in Inquiry-Oriented Undergraduate Mathematics Classes. In S.S. Karunakaran, Z. Reed, and A. Higgins *Proceedings of the 23rd Annual Conference on Research in Undergraduate Mathematics Education* (p. 1060-1065). Boston, MA.
- Serbin, K., Mullins, S.B., Kelley, M.A., & Johnson, E. (2020). Social norms conducive to women’s learning in inquiry-oriented abstract algebra. In A. Isabel Sacristán, J.C Cortés-Zavala, & P.M. Ruiz-Arias (Eds.) *Proceedings of the 42nd Annual Conference of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Mazatlán, Mexico.
- Johnson, E., Andrews-Larson, C., Keene, K., Keller, R., Fortune, N., & Melhuish, K. (2018). Inquiry and inequity in the undergraduate mathematics classroom. In T. Hodges, G. Roy, & A. Tyminski (Eds.), *Proceedings of the 40th Annual Conference of the North American Chapter of the International Group for the Psychology of Mathematics Education* (p. 966-969). Greenville, SC.
- Johnson, E., Keller, R., Fukawa-Connelly, T., Peterson, V. (2018). Individual and situational factors related to lecturing in abstract algebra. In A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, S. Brown (Eds.), *Proceedings of the 21st Annual Conference on Research in Undergraduate Mathematics Education* (pp. 524-532), San Diego, CA.
- Kuster, G., Rupnow, R., Johnson, E., Garrison-Wilhelm, A. (2018). The development of the inquiry-oriented instructional measure. In A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, S. Brown (Eds.), *Proceedings of the 21st Annual Conference on Research in Undergraduate Mathematics Education* (pp. 565-572), San Diego, CA.
- Ellis, E., Johnson, E., & Fosdick, B. (2016). Feeling the squeeze: Factors contributing to experiencing a lack of time in college calculus. In M. Wood, E. Turner, M. Civil, & J. Eli (Eds.), *Proceedings of the 38th Annual Conference of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1317 – 1320). Tucson, AZ.

- Kuster, G. & Johnson, E. (2016). Inquiry-oriented instruction: A conceptualization of the instructional the components and practices. In T. Fukawa-Connelly, N. Engelke Infante, M. Wawro, and S. Brown (Eds.), *Proceedings of the 19th Annual Conference on Research in Undergraduate Mathematics Education* (pp. 979-987), Pittsburgh, PA.
- Johnson, E. (2015). Towards a measure of inquiry-oriented teaching. In T. Fukawa-Connelly, N. Engelke Infante, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 18th Annual Conference on Research in Undergraduate Mathematics Education* (pp. 620-626), Pittsburgh, PA.
- Johnson, E., Ellis, J., & Rasmussen, C. (2014). It's about time: How instructors and students experience time constraints in Calculus I. In P. Liljedahl, C. Nicol, S. Oesterle, & D. Allan (Eds.), *Proceedings of the 38th Conference of the International Group for the Psychology of Mathematics Education and the 36th Conference of the North American Chapter of the Psychology of Mathematics Education Volume 6* (pp. 119) Vancouver, British Columbia.
- Johnson, E. (2014). Two metaphors for realistic mathematics education design heuristics: implications for documenting student learning. In T. Fukawa-Connelly, G. Karakok, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 17th Annual Conference on Research in Undergraduate Mathematics Education* (pp. 121-136; 715-721), Denver, CO.
- Johnson, E. (2013). Implications of Realistic Mathematics Education for Analyzing Student Learning. In S. Brown, G. Karakok, K. H. Roh, and M. Oehrtman, (Eds.) *Proceedings of the 16th Annual Conference on Research in Undergraduate Mathematics Education, Volume 2* (pp. 372-378), Denver, CO.
- Johnson, E. (2012) Mathematical Activity for Teaching. Johnson, E. (2012) Mathematical Activity for Teaching. In S. Brown, S. Larsen, K. Marrongelle, and M. Oehrtman (Eds.), *Proceedings of the 15th Annual Conference on Research in Undergraduate Mathematics Education, Volume 1* (pp. 1-256 – 1-269), Portland, OR.

Invited Presentations

- Johnson, E. (2021). *Undergraduate Math and Science Instructor's Attitudes, Beliefs, and Views on Diversity, Inclusion, and Equity*. Research in Undergraduate Mathematics Education Invited Seminar, Department of Mathematics, University of Oklahoma, Sept 15, 2021.
- Johnson, E. (2021). *Inquiry-oriented Instruction is Better, but Just For Some?*, Invited Colloquium, Department of Mathematics and Statistics, Cal State Long Beach, Sept 17, 2021.
- Johnson, E. (2020). *Taking an instructional innovation to scale: Processing an unexpected result*. Invited Keynote given at 4th Annual NE RUME Conference. Oct. 3, 2020.
- Johnson, E. (2020). *Taking an Instructional Innovation to Scale: Characterizing, Supporting, and Evaluating Inquiry-Oriented Instruction*. Invited Colloquium, Department of Mathematics, Arizona State University. Nov. 13, 2020.
- Johnson, E. (2020). *Taking an Instructional Innovation to Scale: Characterizing, Supporting, and Evaluating Inquiry-Oriented Instruction*. Invited Colloquium, Department of Mathematics, Texas State University. Sept. 4, 2020.
- Johnson, E. (2020). *Some unintended consequences of active learning*. Invited Presentation at the Mathematical Sciences Research Institute's Critical Issues in Mathematics Education 2020 Workshop Series. April 10, 2020.
- Johnson, E. (2019). *Taking an Instructional Innovation to Scale: Characterizing, Supporting, and Evaluating Inquiry-Oriented Instruction*. Invited Colloquium, Mathematics Education Research Seminar, Department of Mathematics, Virginia Commonwealth University. Nov. 19, 2019.

- Johnson, E. (2019). *Inquiry-oriented Instruction is Better... For Some*, Invited Colloquium, Center for Excellence for Science Education, Penn State, April 29, 2019.
- Johnson, E., Fortune, N., Andrews-Larson, C., Keene, K. (2019). Report on TIMES Grant: Characterizing, Supporting, and Evaluating Inquiry-Oriented Instruction. *MAA Invited Paper Session on Research in Improving Undergraduate Mathematical Sciences Education: Examples Supported by the National Science Foundation's IUSE: EHR Program*. Presented at the Joint Mathematical Meetings, Jan 2019, Baltimore, MD.
- Johnson, E., (2018). *Characterizing, Supporting, and Evaluating Inquiry-Oriented Instruction*, Invited Colloquium, Virginia Tech Engineering Education Seminar, Aug 31, 2018.
- Johnson, E., (2018). *Characterizing, Supporting, and Evaluating Inquiry-Oriented Instruction*, Invited Colloquium, University of Arizona Mathematics Department, March 29, 2018.
- Johnson, E. (2017). *MAA's national studies on college calculus: Eye towards Bachelor's granting institutions*, Invited Colloquium, Christopher Newport University Mathematics Department, Oct 26th, 2017.
- Johnson, E., Andrews-Larson, C., Keene, K. (2017). Teaching Inquiry-oriented Mathematics: Establishing Supports. *MAA Invited Paper Session on Research in Improving Undergraduate Mathematical Sciences Education: Examples Supported by the National Science Foundation's IUSE: EHR Program*. Presented at the Joint Mathematical Meetings, Jan 2017, Atlanta, GA.
- Johnson, E. (2015) *Characterizing, Investigating, and Supporting Inquiry-Oriented Teaching*, Invited Colloquium, Colorado State University Mathematics Department, May, 6th, 2015

Recent Teaching Experience

- MATH 3124, Modern Algebra, Spring 2018, Fall 2015, Spring 2015, Spring 2014
Topics in groups, quotient groups, rings, integral domains, fields
- MATH 4625, Mathematics for Secondary Teachers I, Fall 2018, Fall 2014,
Course activities emphasize the curricular themes of problem solving, reasoning and proof, communication, connections, and representation; topics in discrete mathematics and algebra from a secondary teaching perspective
- MATH 4626, Mathematics for Secondary Teachers II, Spring 2020, Spring 2019, Spring 2016,
Course activities emphasize the curricular themes of problem solving, reasoning and proof, communication, connections, and representation; topics in high school mathematics from an advanced perspective
- MATH 4664, Senior Mathematics Education Seminar, Fall, 2020, Fall 2017, Fall 2016, Fall 2015
The main goal of the seminar was to support students in becoming reflective mathematics teachers. A focus on conceptual understanding is used to investigate mathematics content, the teaching of mathematics, and the learning of mathematics.
- MATH 5634, Research in Undergraduate Mathematics Education, Spring 2018, Spring 2014
A survey of the body of research on undergraduate mathematics education, readings focused on: student understanding of undergraduate mathematics content and practices; the development and design of research-based undergraduate curricular materials and the theory that supports such work; the teaching of undergraduate mathematics; and, the state of undergraduate STEM education
- MATH 5984, Special Topics: Research on Teaching, Fall 2019
A survey the body of research on teaching and teaching practice of mathematics and science K-16 education. Readings focused on: instructional practice, influences on instructional practice, and measures of instruction.

Graduate Student Supervision

Ahsan Chowdhury (advisor), PhD, Virginia Tech, 2021, Dissertation Title: Instructors' Orientation on Mathematical Meaning. Current Position: Instructor, George Mason University

Kaitlyn Serbin (advisor), PhD, Virginia Tech 2021, Dissertation Title: The Role of Prospective Teachers' Abstract Algebra Knowledge in Influencing Their Understanding and teaching of Algebra. Current Position: Assistant Professor, University of Texas, Rio Grande Valley.

Rachel Rupnow (advisor), PhD, Virginia Tech, 2019, Dissertation Title: Examining Connections among Instruction, Conceptual Metaphors, and Beliefs of Instructors and Students. Current position: Assistant Professor, University of Northern Illinois

Marilyn Kelley (advisor), M.S., Virginia Tech, 2020, Thesis Title: Teachers' Reflections on Inquiry-Oriented Instruction in Online Professional Development.

Rachel Keller (committee member), PhD, Virginia Tech, 2019

George Kuster (committee member), PhD, Virginia Tech, 2016

David Plaxco (committee member), PhD, Virginia Tech, 2015

Service

Department and University

College of Science Faculty Association, mathematics department representative, 2019 – present

College of Science Diversity Committee, mathematics department representative, 2018 – 2020
(Committee Chair 2019 – 2020)

Mathematics Department Scholarship Committee, 2014 – 2020 (Committee Chair 2019 – 2020)

Mathematics Department InclusiveVT representative, 2017 – 2020

Mathematics Education Committee, 2013 – present

Mathematics Education Preliminary Exam Committee, 2014 – present (Committee Chair 2017 – 2018)

Mathematics Department Undergraduate Program Committee, member, 2016 – 2017

Mathematics Department Teaching Certification Committee, member, 2014 – 2020

Research Community

Secretary for the Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education 2020 – present

Chair of the Family Attending RUME Together Committee of the Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education, 2017 – present

Member of the organizing committee for the 2021 Mathematical Sciences Research Institute (MSRI) workshop in the annual series, Critical Issues in Mathematics Education (CIME): Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors, 2020 – present

Member of the Ad-Hoc Committee for the Advancement of LGBTQIA+ Inclusion in the RUME Community of the Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education, 2018 – 2019

Member of the Program Committee of the Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education, 2014 – 2020

Member of the Equity and Mentoring Committee of the Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education, 2017 – 2019

Member of the Nominating Committee of the Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education, 2016 – 2017

Reviewer for the Journal of Research in Mathematics Education, 2014 – present

Reviewer for the Journal of Mathematical Behavior, 2013 – present

Reviewer for the International Journal for Research in Undergraduate Mathematics Education, 2020 – present

Reviewer for the Annual Conference of the Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education, 2011 – present

Reviewer for the Annual Conference of the North American Chapter of the International Group for the Psychology of Mathematics Education, 2014 – present

Membership in Professional Communities

Mathematical Association of America (MAA)

Special Interest Group of the Mathematical Association of America in Research in Undergraduate Mathematics (SIGMAA on RUME)