

**HEATHER LYNN JOHNSON**

Associate Professor  
University of Colorado Denver  
School of Education & Human Development  
[HthrLynnJ.com](http://HthrLynnJ.com)  
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*I study students' math reasoning. I design tasks to provide students opportunities to expand their math reasoning. I teach teachers to grow their students' math reasoning.*

**EDUCATION**

<b><u>Institution</u></b>	<b><u>Degree</u></b>	<b><u>Date Received</u></b>	<b><u>Major</u></b>
The Pennsylvania State University	Ph.D.	08/2010	Curriculum & Instruction: Mathematics Education
The Pennsylvania State University	M.Ed.	08/1997	Teaching & Curriculum
The Pennsylvania State University	B.S.	05/1992	Mathematics
<b><u>Certificates</u></b>			
National Board for Professional Teaching Standards	Certificate	11/2005	National Board Certification, Mathematics, Adolescence and Young Adulthood
Commonwealth of PA	Certificate	01/1996	Instructional II Certificate, Secondary Mathematics

**PROFESSIONAL EXPERIENCE**

<b><u>Dates</u></b>	<b><u>Position</u></b>
6/2016 – present	Associate Professor of Mathematics Education School of Education and Human Development University of Colorado Denver
08/2010 – 6/2016	Assistant Professor of Mathematics Education School of Education and Human Development University of Colorado Denver
06/2005 - 08/2010	Mid-Atlantic Center Graduate Research Fellow College of Education The Pennsylvania State University
08/1992 - 06/2005	Mathematics Teacher Central York High School York, PA

## PEER REVIEWED PUBLICATIONS

### JOURNAL ARTICLES

- 2018      **Johnson, H. L.**, Dunlap, J., Verma, G., McClintock, E., Debay, D., & Bourdeaux, B. (2018). Video based teaching playgrounds: Designing online learning opportunities to foster professional noticing of teaching practices. *Tech Trends*. doi: 10.1007/s11528-018-0286-5
- Johnson, H. L.** & McClintock, E. (2018). A link between students' discernment of variation in unidirectional change and their use of quantitative variational reasoning. *Educational Studies in Mathematics*. 97(3), 299-316. doi: 10.1007/s10649-017-9799-7
- 2017      **Johnson, H. L.**, Coles, A., & Clarke, D. (2017). Mathematical tasks and the student: Navigating "tensions of intentions" between designers, teachers, and students. *ZDM: The International Journal on Mathematics Education*, 49(6), 813–822. doi.org/10.1007/s11858-017-0894-0
- Johnson, H. L.**, McClintock, E., & Hornbein, P. (2017). Ferris wheels and filling bottles: a case of a student's transfer of covariational reasoning across tasks with different backgrounds and features. *ZDM: The International Journal on Mathematics Education*, 49(6), 851–864. doi.org/10.1007/s11858-017-0866-4
- 2016      Dunlap, J. C., Verma, G., & **Johnson, H. L.** (2016). Presence+Experience: A framework for the purposeful design of presence in online courses. *Tech Trends*, 60(2), 145-151.
- Johnson, H. L.**, Hornbein, P., & Azeem, S. (2016). Investigating functions with a Ferris wheel. *Mathematics Teacher*. 110(5), 345-351.
- Johnson, H. L.**, Hornbein, P., & Bryson, D. (2016). Designing online playgrounds for learning mathematics. *Mathematics Teacher*, 110(4), 298-303.
- 2015      **Johnson, H. L.** (2015) Secondary students' quantification of ratio and rate: A framework for reasoning about change in covarying quantities. *Mathematical Thinking and Learning*, 17(1), 64-90.
- Johnson, H. L.** (2015). Together yet separate: Students' associating amounts of change in quantities involved in rate of change. *Educational Studies in Mathematics*, 89(1), 89-110.
- 2014      **Johnson, H. L.** (2014). A role of context in constructivist model building: What problem is the learner solving? *Constructivist Foundations*, 9(3), 339-341.
- Johnson, H. L.**, Blume, G.W., Shimizu, J., Graysay, D., & Konnova, S. (2014). A teacher's conception of definition and use of examples when doing and teaching mathematics. *Mathematical Thinking and Learning*, 16(4), 285-311.
- 2013      **Johnson, H. L.** (2013). Predicting amounts of change in quantities. *Mathematics Teaching in the Middle School*. 19(5), 260-265.

**Johnson, H. L.** (2013). Reasoning about quantities that change together. *Mathematics Teacher*, 106(9), 704-708.

Castillo-Garsow, C., **Johnson, H. L.**, & Moore, K. (2013). Chunky and smooth images of change. *For the Learning of Mathematics*, 33(3), 31-37.

Tzur, R., **Johnson, H. L.**, McClintock, E., Xin, Y. P., Si, L., Woodward, J., Hord, C., & Jin, X. (2013). Distinguishing schemes and tasks in children's development of multiplicative reasoning. *PNA*, 7(3), 85-101.

2012 **Johnson, H. L.** (2012). Reasoning about variation in the intensity of change in covarying quantities involved in rate of change. *Journal of Mathematical Behavior*, 31(3), 313-330.

2010 **Johnson, H. L.** (2010). Investigating the fundamental theorem of calculus. *Mathematics Teacher*, 103(6), 430-435.

#### CONFERENCE PROCEEDINGS (Since 2016)

In press **Johnson, H. L.**, McClintock, E., Kalir, R., & Olson, G. (in press) Networking theories to design dynamic covariation activities for college algebra students. *To appear in the Proceedings of the 21st Meeting of the MAA Special Interest Group on Research in Undergraduate Mathematics Education*. San Diego, CA: RUME

2017 **Johnson, H. L.**, McClintock, E., Hornbein, P., Gardner, A., & Grieser, D. (2017). When a critical aspect is a conception: Using multiple theories to design dynamic computer environments and tasks to foster students' discernment of covariation. In Dooley, T., & Gueudet, G. (Eds.). *Proceedings of the Tenth Congress of the European Society for Research in Mathematics Education (CERME10)*, pp. 2738-2745). Dublin, Ireland: DCU Institute of Education and ERME.

Tzur, R., **Johnson, H. L.**, Norton, A., Davis, A., Wang, X., Ferrara, M., Jorgensen, C. & Wei, B. (2017). Conception of number as a composite unit predicts students' multiplicative reasoning: Quantitative corroboration of Steffe's model. In B. Kaur, W. K. Ho, T. L. Toh, & B. H. Choy (Eds.), *Proceedings of the 41st Conference of the International Group for the Psychology of Mathematics Education (Vol. 4)*, pp. 289-296). Singapore: PME.

2016 Hodkowski, N. M., Hornbein, P., Gardner, A., **Johnson, H. L.**, Jorgensen, C., & Tzur, R. (2016, November). Designing a stage-sensitive written assessment of elementary students' scheme for multiplicative reasoning. In M. B. Wood, E. E. Turner, M. Civil, & J. A. Eli (Eds.), *Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1581-1587). Tucson, AZ: The University of Arizona.

#### PEER REVIEWED PUBLICATIONS FOR POPULAR AUDIENCES

2018 **Johnson, H. L.** (2018, February 27). Helping students see how graphs work. *EduTopia*. Retrieved from [edutopia.org/article/helping-students-see-how-graphs-work](http://edutopia.org/article/helping-students-see-how-graphs-work)

#### PEER REVIEWED BOOK CHAPTERS (Selected)

2016 **Johnson, H. L.** (2016). Quantitative reasoning in mathematics education: Directions in

research and practice. In R. A. Duschl & A. Bismack (Eds.), *Reconceptualizing STEM education: The central role of practices* (pp. 149-166). London: Routledge, Taylor & Francis

- 2015 **Johnson, H.**, Karunakaran, S., Fox, R., & McClintock, E. (2015). Square root of  $i$ : Situation 9 from the MACMTL-CPTM situations project. In M. K. Heid, P. S. Wilson, with G. W. Blume (Eds.), *Mathematical understanding for secondary teaching: A framework and classroom-based situations* (pp. 171-177). Charlotte, NC: Information Age Publishing
- Johnson, H.**, Karunakaran, S., McClintock, E., Nazarewicz, P., Jacobson, E., & Edenfield, K. (2015). Absolute value in complex plane: Situation 7 from the MACMTL-CPTM situations project. In M. K. Heid, P. S. Wilson, with G. W. Blume (Eds.), *Mathematical understanding for secondary teaching: A framework and classroom-based situations* (pp. 155-161). Charlotte, NC: Information Age Publishing
- Johnson, H.**, McClintock, E., Zbiek, R. M., Gleason, B., Broderick, S., & Wilson J. (2015). Graphing  $\sin(2x)$ : Situation 36 from the MACMTL-CPTM situations project. In M. K. Heid, P. S. Wilson, with G. W. Blume (Eds.), *Mathematical understanding for secondary teaching: A framework and classroom-based situations* (pp. 385-389). Charlotte, NC: Information Age Publishing

## GRANTS FUNDED

### External

- 2017 *Implementing Techtivities to Promote Students' Covariational Reasoning in College Algebra (ITSCoRe)*. PI: **Heather Lynn Johnson**, Co-PIs: Jeremiah Kalir, Gary Olson. National Science Foundation (DUE 1709903). Received: **\$300,000**
- Recruiting and Preparing Exemplary Mathematics and Science Teachers through a Teacher Residency Model*. PI: Doris Kimbrough, Co-PIs: Laurel Hartley, Robert Talbot, Michael Jacobson, **Heather Johnson**. National Science Foundation (DUE 1660770). Received: **\$1,200,000**.
- 2015 *Adaptive Pedagogy for Elementary Teachers: Promoting Multiplicative and Fractional Reasoning to Improve Students' Preparedness for Middle School Mathematics*. PI: Ron Tzur, Co-PIs: Xin Wang, Alan Davis, **Heather Johnson**, Michael Ferrara. National Science Foundation (DRL 1503206). Received: **\$3,000,000**.

### Internal (Since 2016)

- 2017 *International Collaboration to Promote Students' Covariational Reasoning*. PI: **Heather Johnson**. Office of Research Services, University of Colorado Denver. Received: **\$1,500**.
- Making Research Accessible for All: Publishing via Springer's Open Choice*. PI: **Heather Johnson**. Office of Research Services, University of Colorado Denver. Received: **\$1,500**.
- School of Education Faculty Development Grant*. The University of Colorado Denver: School of Education and Human Development. Received: **\$1,500**.

- 2016 *Covariational Reasoning of Secondary Students Using Desmos (CReStD)*. PI: **Heather Johnson**. Office of Research Services, University of Colorado Denver. Received: **\$3,000**.
- School of Education Faculty Development Grant*. The University of Colorado Denver: School of Education and Human Development. Received: **\$1,000**.

## OTHER INDICATORS OF SCHOLARLY AND CREATIVE ACTIVITY

### AUDIOVISUAL MEDIA

- 2018 **Johnson, H. L.** (2018, April 17). *Global Math Department Webinar: Helping students see how graphs work* [Video]. Retrieved from: <https://www.bigmarker.com/GlobalMathDept/Helping-Students-See-How-Graphs-Work?bmid=376c71a2106a>
- Johnson, H. L.** (2018, March 19). *MathEd Podcast Episode 1805* [Audio Podcast]. Retrieved from: [https://www.podomatic.com/podcasts/mathed/episodes/2018-03-19T08\\_32\\_36-07\\_00](https://www.podomatic.com/podcasts/mathed/episodes/2018-03-19T08_32_36-07_00)
- 2015 Annenberg Learner (2015). *Reading and writing in mathematics* [Video]. Retrieved from: <http://www.learner.org/courses/readwrite/video-detail/reading-and-writing-mathematics.html>. Education Experts: Jacob Foster, **Heather Lynn Johnson**, Magdalene Lampert.
- 2013 **Johnson, H. L.** (2013, April 18). *Reasoning about quantities that change together* [Audio Podcast]. Retrieved from: <http://www.nctm.org/Conferences-and-Professional-Development/Webinars-and-Webcasts/Reasoning-about-Quantities-That-Change-Together/>

### INSTRUCTIONAL MATERIALS (Selected)

- 2017 **Johnson, H. L.** (2017). Ferris Wheel: Height v. Width. Retrieved 1 February 2018 from Desmos web site, <https://teacher.desmos.com/activitybuilder/custom/599e0813a7e37e113af6c5b9>
- Johnson, H. L.** (2017). Ferris Wheel: Width v. Distance. Retrieved 1 February 2018 from Desmos web site, <https://teacher.desmos.com/activitybuilder/custom/599de9948ac1a60bcfcd20d8>
- Johnson, H. L.** (2017). Ferris Wheel: Height v. Distance. Retrieved 1 February 2018 from Desmos web site, <https://teacher.desmos.com/activitybuilder/custom/59a7272c5e844d0a1dfcfe7>
- Johnson, H. L.** (2017). The Toy Car. Retrieved 19 July 2017 from Desmos web site, <https://teacher.desmos.com/activitybuilder/custom/58bf63e46955550a3dc61f59>.
- Johnson, H. L.** (2017). The Cannon Man. Retrieved 22 January 2017 from Desmos web site, <https://teacher.desmos.com/activitybuilder/custom/582516579ecbaeb00793586e>.

**PEER REVIEWED PRESENTATIONS AT MEETINGS/CONFERENCES (Since 2016)**

- 2018      Smith, A., Gardner, A., & **Johnson, H. L.** (2018, August, accepted) Techtivities: Help students see how graphs work. *Annual Meeting of the Colorado Council of Teachers of Mathematics*, Denver, CO.
- Olson, G., **Johnson, H. L.**, & Kalir, J. (2018, August, accepted). Implementing Desmos techtivities to promote students' covariational reasoning. *2018 Math Fest Meeting of the Mathematical Association of America*, Denver, CO.
- Johnson, H. L.**, Olson, G., Kalir, J., Gardner, A., & Smith, A. (2018, June, accepted): Questioning our questions: From soliciting answers to eliciting reasoning. *National Inquiry Based Learning Conference*, Austin, TX.
- Olson, G., **Johnson, H. L.**, Kalir, J., Gardner, A., & Smith, A. (2018, June, accepted): Two graphs are better than one: Techtivities for College Algebra. *National Inquiry Based Learning Conference*, Austin, TX.
- Olson, G., Kalir, J., & **Johnson, H. L.** (2018, April). Desmos techtivities for the college algebra classroom. *2018 Meeting of the Rocky Mountain Section of the Mathematical Association of America*, Pueblo, CO.
- Coughlin, J. P., **Johnson, H. L.**, & Mays, D. C. (2018, March). Genetic decomposition: How do students learn to turn concepts into relationships? *Zone IV Meeting of the American Society for Engineering Education*, Boulder, CO.
- 2017      **Johnson, H. L.** (2017, April). Didn't you learn that in high school? Why students struggle with rate and function, and how a covariation approach can help. *2017 Meeting of the Rocky Mountain Section of the Mathematical Association of America*, Pueblo, CO.
- Johnson, H. L.** & Tzur, R. (2017, April). Adapting Instruction to students' mathematical thinking: 5 practices of student adaptive pedagogy. *2017 Meeting of the Rocky Mountain Section of the Mathematical Association of America*, Pueblo, CO.
- Johnson, H. L.**, Hornbein, P., & Bryson, D. (2017, April). Designing online playgrounds for learning mathematics. *National Council of Teachers of Mathematics' 95th Annual Meeting*, San Antonio, TX.
- Johnson, H. L.**, Wang X., Tzur, R., & Sutton, J. (2017, April). Developing written, prompt-sensitive measures of multiplicative reasoning. *National Council of Teachers of Mathematics' Annual Research Meeting*, San Antonio, TX.
- Sutton, J., **Johnson, H. L.**, & Tzur, R. (2017, April). Changing instructional practice—Permission isn't enough—Teachers need adaptive pedagogy to support student learning. *Annual Meeting of the National Council of Supervisors of Mathematics*, San Antonio, TX.
- 2016      Dunlap, J. C., Verma, G., & **Johnson, H. L.** (2016, October). The Presence+Experience framework: Supporting the purposeful design of presence in online courses. *Association*

*for Educational Communications and Technology International Convention, Las Vegas, NV.*

Hornbein, P., & Azeem, S., & **Johnson, H. L.** (2016, September). Investigating function with a Ferris wheel. *Annual Meeting of the Colorado Council of Teachers of Mathematics*, Denver, CO.

**Johnson, H. L.** (2016, July). Designing technology-rich tasks to foster secondary students' covariational reasoning. *13th International Congress on Mathematical Education*, Hamburg, Germany.

**Johnson, H. L.**, McClintock, E., & Hornbein, P. (2016, April). Ferris wheels and filling bottles: Investigating a student's transfer. *National Council of Teachers of Mathematics' Annual Research Meeting*, San Francisco, CA.

#### **INVITED PRESENTATIONS (Since 2016)**

2017 **Johnson, H. L.** (2017, December). Promote students' smooth covariational reasoning. *Mathematics Education Colloquium*. Tempe, AZ: Arizona State University. \$200 honorarium.

**Johnson, H. L.** (2017, November). Networking theories to design techtivities to promote students' covariational reasoning. *Universiteit Utrecht Freudenthal Institute Research Meeting*, Utrecht, Netherlands.

**Johnson, H. L.** (2017, October). Task design to promote students' covariational reasoning: A multi-theoretic approach. *Universität Bremen Mathematisches Kolloquium*. Bremen, Germany. €200 honorarium.

**Johnson, H. L.** (2017, September). Networking theories to design dynamic computer environments to foster students' quantitative and covariational reasoning. *Mathematics Education Research Colloquium*, Linköping, Sweden: Linköping University.

Harding, J., **Johnson, H. L.**, & Kitchen, R. (2017, April). K-8 math specialist panel discussion. *2017 Meeting of the Rocky Mountain Section of the Mathematical Association of America*, Pueblo, CO.

2016 Pape, S., Munter, C., Beckmann, S., Leatham, K. R., Silver, E. A., **Johnson, H. L.**, Dixon, J. K., Boston, M. D., Arbaugh, F., & Kastberg, S. (2016, April). Graduate student, junior faculty, and researcher mentoring session. *Invited Mentoring Session for the National Council of Teachers of Mathematics' Annual Research Conference*, San Francisco, CA.

#### **SEMINARS & WORKSHOPS PRESENTED (Since 2016)**

2017 **Johnson, H. L.** (2017, October). Task design in mathematics education: Development, navigation, iteration. *Doctoral Student Seminar, Universität Bremen Mathematisches Kolloquium*. Bremen, Germany.

**Johnson, H. L.** (2017, September). Quantity, covariation, and images of change. *Mathematics and Education Faculty Seminar*. Linköping, Sweden: Linköping University

2016 **Johnson, H. L.** (2016, April). Didn't you learn that in high school? Why students struggle with rate and function, and how a covariation approach can help. *Critical Issues in Undergraduate Mathematics Education Seminar*, University of Colorado Denver. Denver, CO.

**Johnson, H. L.** (2016, April). Making sense of change in a changing world. *School of Education and Human Development Assistant Professor Lecture Series*. University of Colorado Denver, Denver, CO.

**COURSES**

*PROGRAMS/CERTIFICATES*

<u>CERTIFICATE</u>	<u>Level</u>	<u>Department</u>	<u>Institution</u>
Mathematical Content Knowledge for Teaching (Fully Online; 9 credits) <i>Developed, Taught, Revised</i>	Graduate	School of Education and Human Development	University of Colorado Denver
<i>TAUGHT (FACE TO FACE)</i>			

<u>Course</u>	<u>Level</u>	<u>Department</u>	<u>Institution</u>
Developmental Pathways in Students' Mathematical Thinking, MTED 5060/7060, <i>Revised</i>	Graduate	School of Education and Human Development	University of Colorado Denver
Mathematics for Elementary Teachers, UEDU 5400/MATH 3040	Graduate/ Undergraduate	School of Education and Human Development	University of Colorado Denver
Teaching Elementary Mathematics I, UEDU 5002/4002	Graduate/ Undergraduate	School of Education and Human Development	University of Colorado Denver
Teaching Elementary Mathematics II, UEDU 5003/4003	Graduate/ Undergraduate	School of Education and Human Development	University of Colorado Denver
Teaching Secondary Mathematics I, MTHED 411 <i>TAUGHT (BLENDED)</i>	Undergraduate	College of Education	The Pennsylvania State University

<u>Course</u>	<u>Level</u>	<u>Department</u>	<u>Institution</u>
Critique of Mathematics Education Research, MTED 7050/5050, <i>Developed</i>	Graduate	School of Education and Human Development	University of Colorado Denver



Curriculum and Methods in Secondary Mathematics, UEDU 5300/4300, <i>Revised</i>	Graduate/ Undergraduate	School of Education and Human Development	University of Colorado Denver
Theories of Mathematical Learning, MTED 5030/7030, <i>Developed for a hybrid format</i>	Graduate	School of Education and Human Development	University of Colorado Denver

TAUGHT (FULLY ONLINE)

<u>Course</u>	<u>Level</u>	<u>Department</u>	<u>Institution</u>
Assessment and Equity in Secondary Mathematics, UEDU 5301/4301, <i>Developed</i>	Graduate/ Undergraduate	School of Education and Human Development	University of Colorado Denver
Expanding Conceptions of Algebra: Algebraic Reasoning Underlying K-12 Common Core Standards, MTED 5622, <i>Developed</i>	Graduate	School of Education and Human Development	University of Colorado Denver
Geometrical Ways of Reasoning Underlying K-12 Common Core Standards, MTED 5623, <i>Developed</i>	Graduate	School of Education and Human Development	University of Colorado Denver
A World of (Different) Numbers: Quantities & Operations Underlying k-12 Common Core Standards, MTED 5621, <i>Developed</i>	Graduate	School of Education and Human Development	University of Colorado Denver

**SERVICE (Selected)**

*SERVICE TO COMMUNITY: BOARD SERVICE*

<u>Membership</u>	<u>Date(s)</u>	<u>Board</u>	<u>Level (Regional, State, National, International)</u>
<i>Member</i>	06/2018 – Present	Colorado Council of Teachers of Mathematics Board of Directors	State

*SERVICE TO PROFESSION: CONFERENCE PLANNING/LEADERSHIP*

<u>Role</u>	<u>Date(s)</u>	<u>Conference/Meeting</u>
<i>Co-Leader: Thematic Working Group #17: Theoretical Perspectives and Approaches in Mathematics Education Research</i>	11/2017-2/2019	Eleventh Congress of the European Society for Research in Mathematics Education, Utrecht, Netherlands

*SERVICE TO PROFESSION: EDITORIAL SERVICE*

**Editor**

2018-Present *Colorado Math Teacher Journal*, Colorado Council of Teachers of Mathematics.  
<http://www.cctmath.org/cmtjournal/>

**Member of Editorial Board**

2016-Present *Mathematical Thinking and Learning*, Taylor & Francis. 5-year Impact Factor: 1.09

**Member of Editorial Team**

2015-2017 Mathematical Tasks and the Student, *ZDM Mathematics Education*, 2017 (6)

**Co-Editor**

2014-2017 Technology Tips Department, *Mathematics Teacher*, National Council of Teachers of Mathematics.

**AWARDS/HONORS**

*External*

4/2014 Linking Research and Practice Outstanding Publication Award – Mathematics Teacher.  
National Council of Teachers of Mathematics.  
*Publication: Johnson, H. L. (2013). Reasoning about quantities that change together. Mathematics Teacher, 106(9), 704-708.*

7/2011 STaR Fellow  
Service, Teaching, and Research for Early Career Mathematics Educators  
National Science Foundation

3/2003 Presidential Award for Excellence in Mathematics Teaching (\$10,000)  
National Science Foundation

*Internal*

2/2015 Faculty Award: Excellence in Teaching  
School of Education and Human Development, University of Colorado Denver

4/2014 Faculty Award: Excellence in Research and Creative Activities  
School of Education and Human Development, University of Colorado Denver