Mitchell J. Nathan

Associate Chair
Educational Psychology Department

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Education

PhD	University of Colorado at Boulder, Cognitive Psychology (Chair, Prof. Walter Kintsch). A theory of word problem comprehension and its implications for the design of learning environments. August 1991.
MA	University of Colorado at Boulder, Psychology (Chair, Prof. Walter Kintsch) Recall of stories and story problems. August 1988.
BS	Carnegie Mellon University, Triple major in Electrical and Computer Engineering (BSEE), History (BA), and Mathematics (BS). May 1984.

Scholarly Appointments

Professor, University of Wisconsin-Madison, School of Education, Department of Educational Psychology (Learning Sciences). August 2007 to date.

Affiliate Professor, Psychology Department University of Wisconsin-Madison, College of Letters and Sciences. August 2004 to date.

Affiliate Professor, Department of Curriculum and Instruction (Mathematics Education and Science Education), University of Wisconsin-Madison, School of Education. August 2004 to date.

Affiliate Professor, Center on Education and Work, University of Wisconsin-Madison, School of Education, Oct. 2007 to 2018.

Associate Professor with tenure, University of Wisconsin-Madison, School of Education, Department of Educational Psychology. August 2004 to August 2007.

Affiliate Professor, Wisconsin Center for Education Research (WCER), University of Wisconsin-Madison, School of Education, July 2004 to date.

Associate Professor with tenure, University of Colorado-Boulder, School of Education, Educational Psychology. June 2002 to July 2004.

Fellow, Institute of Cognitive Science, University of Colorado-Boulder. Aug. 1995 to 2004.

Assistant Professor, University of Colorado-Boulder, School of Education, Educational Psychology. Aug. 1995 to June 2002.

Senior Research Associate, Learning Technology Center, Peabody College, Vanderbilt University. Develop and assess multimedia-based instructional environments for mathematics and science learning for JH and H S grades. Sept. 1993 to Aug. 1995.

Post-Doctoral Research Fellow, University of Pittsburgh, Learning Research and Development Center (LRDC). Sept. 1991 to Aug. 1993.

Research Scientist in Intelligent Tutoring and Distributed Intelligent Systems, U S West Advanced Technologies, Boulder, CO. Sept. 1989 to Aug. 1991.

Consultant in artificial intelligence (AI) and software design and development, Boulder Heuristics, Inc., Boulder, CO. Apr 1987 to Sept. 1989.

Engineer, Martin Marietta Denver Aerospace Robotics Lab. Hardware and software design for low and high-level real-time robotic vision systems and mobile robots. Jun. 1984 to Aug. 1986.

Research Assistant, "Social implications of robotics." Carnegie Mellon University, Dept. of Engineering & Public Policy / Robotics Institute. June 1983 to May 1984.

Administrative Positions

Associate Chair, Educational Psychology Dept., UW-Madison. 2021-date.

Director, MAGIC Lab, Wisconsin Center for Education Research, University of Wisconsin-Madison. Aug. 2010 to date. MATHEMATICAL ACTION AND GESTURE IN INSTRUCTION AND COGNITION. Develop theory, research methods, and designs of digital learning resources (visual novels, video games, immersive AR/VR) for the study and improvement of mathematical thinking, teaching, learning, and assessment based on the grounded and embodied learning (GEL) framework.

Director, Center on Education and Work, School of Education, University of Wisconsin–Madison, Dec. 2011 to 2018. Center houses research and development on academic and career planning, workforce development, and STEM education learning, teaching, and policy research.

Director, Postdoctoral Training Program in Mathematical Thinking, Learning, and Instruction, University of Wisconsin-Madison, Mar. 2010 – Aug. 2017.

Co-Chair, Program Committee for the Tenth International Conference on Computer Supported Collaborative Learning (CSCL10), Madison, WI. 2011-2013.

Chair-designate (2008), and Chair (2009-2011), Annual Meeting Policies and Procedures Committee, American Educational Research Association (AERA).

Chair, Learning Sciences Program, Department of Educational Psychology, School of Education, University of Wisconsin-Madison, 2005-2010.

Program Chair, Division C of American Educational Research Association (AERA), 2007-2008.

Founding Secretary/Treasurer, International Society of the Learning Sciences (ISLS), 2002-2005.

Chair, Educational Psychology, University of Colorado-Boulder, Fall, 1998.

Visiting Scholar Appointments

Visiting Lecturer, Latin American School for Education, Cognitive, and Neural Sciences, Buenos Aires, Argentina. Integrative Neuroscience Laboratory of the Torcuato Di Tella University, March 2016

Visiting Lecturer, Latin American School for Education, Cognitive, and Neural Sciences, San Pedro de Atacama, Chile. Centro de Investigación Avanzada en Educación – Universidad de Chile/Center for Advanced Research in Education University of Chile, March 2015

Visiting Lecturer, Latin American School for Education, Cognitive, and Neural Sciences, Punta del Este, Uruguay, March 2014

Visiting Lecturer, Latin American School for Education, Cognitive, and Neural Sciences, Commandatuba, Bahia, Brazil, March 2013

Visiting Professor, Department of Psychology, University of California-Santa Barbara, Jan-Mar 2012

Visiting Lecturer, Latin American School for Education, Cognitive, and Neural Sciences, El Calafate, Patagonia, Argentina. March 2012

Visiting Lecturer, Latin American School for Education, Cognitive, and Neural Sciences, San Pedro de Atacama, Chile. Centro de Investigación Avanzada en Educación – Universidad de Chile/Center for Advanced Research in Education University of Chile, March, 2011

Honorary Fellow, Dept. of Educational Psychology, School of Education, University of Wisconsin-Madison. Jan. – Jul. 2003

Awards & Honors

Vilas Associates Award, University of Wisconsin-Madison (Social Sciences Division), Office of the Vice Chancellor for Research and Graduate Education. 2022.

Best Design Paper Award, 16th International Conference of the Learning Sciences-ICLS2022. International Society of the Learning Sciences. 2022.

Facilitators' Choice Award, 2020 STEM For All Video Showcase, "The Hidden Village: Mathematical Reasoning Through Movement." Multiplex.videohall.com/presentations/1662

Vilas Distinguished Achievement Professor, University of Wisconsin-Madison. 2018.

Fellow, International Society of the Learning Sciences. 2018.

Hilldale Undergraduate/Faculty Research Fellowship Award, University of Wisconsin. 2015-16.

Inductee, Teaching Academy, University of Wisconsin-Madison. 2014.

Exceptionality Designation, Dept. of Educational Psychology, University of Wisconsin. 2008-2009.

Outstanding Reviewer, Review of Educational Research, American Educational Research Association. 2007.

Distinguished Publisher's Award, Theoretical and applied research in robotic vision and reasoning systems, Martin Marietta Denver Aerospace. 1986.

Research Grants and Fellowships

Principal Investigator, "Testing an Embodied Theory of Transfer of Learning," Vilas Associates Competition – Social Sciences Division, Office of the Vice Chancellor for Research and Graduate Education. Award: $77,000 (direct costs), Jul. 2022 – Jun. 2024.

Principal Investigator, "Understanding Teacher Change and Teachers as Learners in K-12 Classrooms (TAL)," James S. McDonnell Foundation. Award: $353,656 (direct costs), Jan. 2021 – Dec. 2023.

Co-Principal Investigator, "Exploring Collaborative Embodiment for Learning (EXCEL): Understanding Geometry Through Multiple Modalities," from the U. S. Dept. of Education-Institute of Educational Sciences (IES). Grant No. R305A200401. Award: $1.4M, August 2020 – July 2024, with C. Walkington (PI; Southern Methodist University).

Principal Investigator, "DCL: Synthesis and Design Workshop: The Future of Embodied Design for Mathematical Imagination and Cognition," National Science Foundation (NSF) DRL – Core R&D NSF-DCL Grant #1824662. Award: $99,996, Sep. 01, 2018 - Aug 31, 2020.

Principal Investigator, "Teachers as Learners Program," James S. McDonnell Foundation. Award: $325,031, May 2017 – April 2020 (NCE till April 2021).

Principal Investigator, "How Dynamic Gestures and Directed Actions Contribute to Mathematical Proof Practices," from the U. S. Dept. of Education-Institute of Educational Sciences (IES). Grant No. R305A160020. Award: $1.4M, July 2016 – June 2020, with P. Steiner and C. Walkington (Southern Methodist University) (NCE till June 2022).

Hilldale Undergraduate/Faculty Research Fellowship, University of Wisconsin-Madison. $3,500. 2015-2016 James Xu, Student PI.

Principal Investigator, “Postdoctoral Training Program in Mathematical Thinking, Learning, and Instruction,” from the U. S. Dept. of Education-Institute of Educational Sciences (IES). Grant No. R305B130007. Award: $686,999 Sep. 2013 – Aug. 2017, with M. W. Alibali, A. Ellis, C. Kalish, E. Knuth, P. Steiner, & A. Wager.

Co-Principal Investigator, “Connecting Mathematical Ideas through Animated Multimodal Instruction,” from U. S. Dept. of Education-Institute of Education Sciences, Cognition and Student Learning Program. Grant No. R305A130016. Award: $1,599,991 Jun 2013 – May 2019 (NCE), with M. W. Alibali (PI), V. Popescu (Purdue), N. Adamo-Villani (Purdue), and S. Cook (U. Iowa).

Co-Principal Investigator (PI for University of Wisconsin sub-award), “National Center for Cognition and Mathematics Instruction” from U. S. Dept. of Education-Institute of Education Sciences, Education Research and Development Centers Program. Grant No. R305C100024. Award: $9,998,406 Sep. 2010 – Aug. 2015, with Steven Schneider (PI, WestEd), James Pellegrino (UIC), Susan Goldman (UIC), Kenneth Koedinger (CMU), Neil Heffernan (WPI), Julie Booth (Temple), Martha W. Alibali (UW), Diane Briars (Pittsburgh Public Schools), and Shandy Hauk (WestEd).

Principal Investigator, “Postdoctoral fellowship program in mathematical thinking, learning and instruction” from the U. S. Dept. of Education-Institute of Educational Sciences (IES; Grant No. R305B100007). Award: $655,000 Aug. 2010 – Jul. 2015, with M. W. Alibali, A. Ellis, D. Kaplan, C. Kalish, E. Knuth, & A. Wager.

Co-Principal Investigator, "How does teachers' visual scaffolding support students' mathematics learning?" from National Science Foundation Research and Evaluation on Education in Science and Engineering (NSF-REESE). DRL 0909699. Award $999,789 Sep 2009 - Aug 2012, with M. W. Alibali (PI), E. Knuth, and R. B. Church (Northeastern Illinois University).

Principal Investigator, “Tangibility for the teaching, learning, and communicating of mathematics,” (Sub-Award from San Diego State University; Ricardo Nemirovsky, PI) from National Science Foundation Research and Evaluation on Education in Science and Engineering (NSF-REESE, DRL-0816406). (Sub-Award $645,000 Sep. 2008-Aug. 2013. Full Award $2,000,000) With M. W. Alibali (University of Wisconsin–Madison), R. Hall and K. Leander (Vanderbilt University).

Co-Principal Investigator (PI for University of Wisconsin School of Education sub-award), “Aligning educational experiences with ways of knowing engineering (AWAKEN),” sponsored by the National Science Foundation Engineering Education Program (NSFEEP; Grant No. EEC-0648267). (Award $978,000 July 2007-June 2010; No Cost Extension through Aug. 2011) With S. Courter (PI) and A. Phelps.

Co-Principal Investigator, "Does Visual Scaffolding Facilitate Students' Mathematics Learning? Evidence From Early Algebra," sponsored by the U. S. Dept. of Education Institute of Educational Sciences (IES; Grant No. R305H060097). (Award: $982,736, Sept. 2006 – Aug. 2009; No Cost Extension through Aug. 2011), with M. W. Alibali (PI), E. Knuth, and R. B. Church (Northeastern Illinois University).

Principal Investigator, “STAAR Teacher professional development project.” Sub-contract from Carnegie Mellon University ($280,000 Oct. 2004-Sept. 2007).

Principal Investigator, “Collaborative Research: Understanding and Cultivating the Transition from Arithmetic to Algebraic Reasoning.” Sub-contract from the University of Colorado ($104,266 July 2004 - Sept. 2006).

Principal Investigator, “Understanding and Cultivating the Transition from Arithmetic to Algebraic Reasoning,” sponsored by the Interagency Education Research Initiative (IERI; a collaboration of NSF, Dept. Of Education-OERI/IES, and NIH-NICHHD; total award $5,798,281 Oct. 2001–Sep. 2006). (NSF 0115609, 0115635 and 0115661 under IERI collaborative research.) With Co-PI’s H. Borko, H. Kupermintz, J. Frykholm (University of Colorado), S. Derry, M. W. Alibali, and E. Knuth (University of Wisconsin–Madison), and K. R. Koedinger (Carnegie Mellon).

Co-Principal Investigator, “Preparing Tomorrow’s Teachers to use Technology” (PT3) Implementation grant issued by U. S. Dept of Education, Office of Post-Secondary Education ($1,170,000 2000-2002, Award P342A000115) with Profs. M. Meloth and D. D. Peressini (PI).

Co-Principal Investigator, “Bridges to representational fluency: Grounding and abstraction in early algebra instruction” from the James S. McDonnell Foundation ($771,000 Jun 1998 – May 2002) with K. R. Koedinger (PI) & M. W. Alibali.

Co-Principal Investigator, "Understanding informal algebra and bridging to symbolic algebra" from the James S. McDonnell Foundation ($416,560 Jan. 1995 - Dec. 1997), with K. R. Koedinger (PI) and H. J. M. Tabachneck.

Principal Investigator, post-doctoral fellowship "Cognitive studies for educational practice" James S. McDonnell Foundation (Grant no. 91-18) under the supervision of Prof. L. B. Resnick, LRDC, University of Pittsburgh (Sept. 1991 to Aug. 1993).

Books

1. **Nathan, M. J.** (2022). *Foundations of embodied learning: A paradigm for education*. Routledge. ISBN-13: 9780367349752 (hardback); 9780367349769 (paperback); 9781000430073 (ebook).

2. **Consensus Committee for the National Academies of Sciences, Engineering, and Medicine**. (2019). *Science and Engineering for Grades 6-12: Investigation and Design at the Center*. Washington, DC: The National Academies Press. doi.org/10.17226/25216.

3. Dwayne Day, Rapporteur & **The Planning Committee on Sharing the Adventure** (2015). *Sharing the Adventure with the Student: Exploring the Intersections of NASA Space Science and Education: A Workshop.* Space Studies Board; Division on Engineering and Physical Sciences; Board on Science Education; and the National Research Council. Washington DC: National Academies Press.

4. **Committee on Integrated STEM Education. National Academy of Engineering and National Research Council** (2014). *STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research*. Margaret Honey, Greg Pearson, and Heidi Schweingruber (Eds.). Washington, DC: The National Academies Press.

5. Rummel, N., Kapur, M., **Nathan, M. J.**, & Puntambekar, S. (Eds.) (2013a). *To See the World and a Grain of Sand: Learning across Levels of Space, Time, and Scale: Proceedings of the Tenth Computer Supported Collaborative Learning Conference (CSCL10)*, *Volume I*. Madison, WI, USA: University of Wisconsin.

6. Rummel, N., Kapur, M., **Nathan, M. J.**, & Puntambekar, S. (Eds.) (2013b). *To See the World and a Grain of Sand: Learning across Levels of Space, Time, and Scale: Proceedings of the Tenth Computer Supported Collaborative Learning Conference (CSCL10), Volume II*. Madison, WI, USA: University of Wisconsin.

In Preparation and Under Review

(*N. B.* * Student co-authors; + Postdoctoral fellow co-authors)

i. Kolovou, M. & **Nathan, M. J.** (In preparation). Leveraging embodied holistic experiences to science learning: The IDI model.

ii. *Schenck, K. E. & **Nathan, M. J.** (Under review). Navigating spatial ability for mathematics education: A review and roadmap.

iii. *Sung, H. & **Nathan, M. J.** (In preparation). How do we collect, analyze, and interpret multimodal data? Multimodal learning analysis in CSCL environments.

iv. *Sung, H., Swart, M. I., & **Nathan, M. J.** (Under review). Improving pre-service teachers' noticing and attitudes about embodied mathematical reasoning through collaborative online professional learning. Preprint Doi 10.31234/osf.io/c2e46. psyarxiv.com/c2e46

v. Swart, M. I., *Sung, H., *Kirankumar, V., *Xia, F., *Kim, D., Kwon, O. H., *Schenck, K., Walkington, C., & **Nathan, M. J.** (In preparation). Embodied transmission of ideas: Collaborative construction of geometry content and mathematical thinking.

vi. Walkington, C., **Nathan, M. J.**, *Wang, M., Swart, M. I., *Holcomb-Webb, K., *Schenck, K., & *Washington, J. (Under review). The development of gestural knowledge through collaborative problem posing of geometric movements.

vii. *Xia, F. & **Nathan, M. J.** (In preparation). Eliciting predictive behaviors to support embodied geometric reasoning.

viii. *Zhao, Y. & **Nathan, M. J.** (Under review). Understanding gestures in a concreteness fading vector addition learning intervention.

Refereed Publications & Peer-Reviewed Conference Papers

1. Walkington, C., **Nathan, M. J.**, +Huang, W., *Hunnicutt, J., & *Washington, J. (accepted pending revisions). Multimodal analysis of interaction data from embodied education technologies. *Educational Technology Research & Development*.

2. *Fogel, A., Swart, M. I., *Grondin, M., & **Nathan, M. J.** (2023, June). Pose detection: Towards ubiquitous embodied interventions. *Proceedings of the 17th International Conference of the Learning Sciences-ICLS2023*

3. *Fogel, A., Swart, M. I., *Grondin, M., Xia, F., Schenck, K. E., & **Nathan, M. J.** (2023, June). Scaffolding the conceptual salience of directed actions. *Proceedings of the 17th International Conference of the Learning Sciences-ICLS2023.*

4. Kim, D. & **Nathan, M. J.** (2023, June). The effect of instructed actions on embodied geometric reasoning. *Proceedings of the 17th International Conference of the Learning Sciences-ICLS2023.*

5. *Grondin, M., Swart, M. I., *Kim, D., & **Nathan, M. J.** (2023, April). Embodying engineering students' knowledge through gesture. Paper presented at the 2023 Annual Meeting of the American Educational Research Association, Chicago, IL. AERA.

6. +Huang, W., Walkington, C., & **Nathan, M. J.** (2023, June). Coordinating modalities of mathematical collaboration in shared VR environments. *International Journal of Computer-Supported Collaborative Learning*.

7. **Nathan, M. J.** (2023). Disembodied AI and the Limits to Machine Understanding of Students' Embodied Interactions. *Frontiers in Artificial Intelligence–AI for Human Learning and Behavior Change, 6:1148227.* doi: 10.3389/frai.2023.1148227

8. Swart, M. I., *Schenck, K. E., *Xia, F., *Kim, D., *Grondin, M., Walkington, C., & **Nathan, M. J.** (2023, April). Embodying students' geometric thinking through an interactive narrative game. Paper presented at the 2023 Annual Meeting of the American Educational Research Association, Chicago, IL. AERA.

9. *Washington, J. C., *Hunnicutt, J. D., *Darwin, T., Milton, S. L., Walkington, C., & **Nathan, M. J.** (2023, April). Perspective-taking, scale, and dynamicity in augmented reality for learning geometry. Paper presented at the 2023 Annual Meeting of the American Educational Research Association, Chicago, IL. AERA.

10. *Xia, F., Swart, M. I., Schenck, K. E., & **Nathan, M. J.** (2023, June). Gestural replays support mathematical reasoning by simulating geometric transformations. *Proceedings of the 17th International Conference of the Learning Sciences-ICLS2023*

11. *Zhao, Y. & **Nathan, M. J.** (2023, April). High school students' embodied reasoning about vectors. Paper presented at the 2023 Annual Meeting of the American Educational Research Association, Chicago, IL. AERA.

12. *Fogel, A., Swart, M., *Grondin, M., & **Nathan, M. J.** (2022, November). Grounding embodied learning using online motion-detection in *The Hidden Village*. Iyer, S. et al. (Eds.) (2022). *Proceedings of the 30th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education*.

    https://drive.google.com/file/d/167Z0KVNAWqv3u-Rxb2cLXlx6cdtjP17p/view?usp=share_link12OrY1o5ZiPb_T3LHL7tQ8hZ7htbe_lm

13. *Grondin, M. M., Swart, M. I., *Xia, F., & **Nathan, M. J.** (2022, June). Assessing engineering students' embodied knowledge of torsional loading through gesture. (ASEE Paper ID #2022-383, pp. 1-14). Paper presentation to the American Society of Engineering Education ASEE 2022, Engineering Research Methods (ERM) Division. Minneapolis, MN: ASEE.

14. *Grondin, M. M. & **Nathan, M. J.** (2022, July). Gesture-speech mismatch in engineering. To appear in *Proceedings of the International Society of Gesture Studies 9*. Loyola University, Chicago, IL. ISGS.

15. **Nathan, M. J.**, Walkington, C., & Swart, M. I. (2022, June). Designs for grounded and embodied mathematical learning. In Chinn, C., Tan, E., Chan, C., & Kali, Y. (Eds.). *Proceedings of the 16th International Conference of the Learning Sciences-ICLS2022* (pp. 179-186). Hiroshima, Japan: International Society of the Learning Sciences.

    N. B. Received Best Design Paper Award for ICLS 2022.

16. **Nathan, M. J.**, Walkington, C., & Swart, M. I. (2022, July). Gesture production in geometry proof practices and education: Description, function, mechanism, and application to a digital embodied learning environment. *Proceedings of the International Society of Gesture Studies 9*. Loyola University, Chicago, IL. ISGS.

17. *Schenck, K. E., Hubbard, E. M., **Nathan, M. J.,** & Swart, M. (2022). Expanding understandings of embodied mathematical cognition in students' fraction knowledge. In *Proceedings of the Annual Meeting of the Cognitive Science Society* (Vol. 44, No. 44).

18. *Schenck, K. & **Nathan, M. J.** (2022, April). With no universal consensus, choice of spatial frameworks can affect model fitting and interpretation. Paper presented at the 2022 Annual Meeting of the American Educational Research Association, San Diego, CA. AERA.

19. *Sung, H., Swart, M., & **Nathan, M. J.** (2022, October). Unraveling Temporally Entangled Multimodal Interactions in CSCL Environments. Paper presented at the International Conference on Quantitative Ethnography (ICQE) 2022. Copenhagen, Denmark. www.icqe22.org

20. *Sung, H., Swart, M., & **Nathan, M. J.** (2022, April). Teaching teachers teaching students: How embodied cognition can help pre-service teachers assess student's mathematical thinking. Paper presented at the 2022 Annual Meeting of the American Educational Research Association, San Diego, CA. AERA.

21. *Sung, H., Swart, M. I., & **Nathan, M. J.** (2022, June). Methods for analyzing temporally entangled multimodal data. In Weinberger, A. Chen, W., Hernández-Leo, D., & Chen, B. (Eds.). *Proceedings of the 15th International Conference on Computer-Supported Collaborative Learning -CSCL 2022* (pp. 242-249). Hiroshima, Japan: International Society of the Learning Sciences.

    N. B. Received Naomi Miyake Memorial Best Student Paper Award for CSCL 2022.

22. Walkington, C., **Nathan, M. J.,** & +Huang, W. (2022, April). Transforming teachers' understanding of the possibilities for geometry instruction through virtual reality. In Symposium "Technologies for Situated, Grounded, Embodied Learning: The Unique Role of

Extended Reality Experiences." Paper presented at the 2022 Annual Meeting of the American Educational Research Association, San Diego, CA. AERA.

23. Walkington, C., **Nathan, M.J.,** *Hunnicutt, J., *Washington, J., & *Holcomb-Webb, K. (2022, June). Learning geometry through collaborative, embodied explorations with augmented reality holograms. In *Proceedings of the 16th International Conference of the Learning Sciences-ICLS2022* (pp. 1992- 1993). Hiroshima, Japan: International Society of the Learning Sciences.

24. Walkington, C., **Nathan, M. J.,** *Wang, M. & *Schenck, K. (2022). The effect of cognitive relevance of directed actions on mathematical reasoning. *Cognitive Science, 46*(9), e13180. doi.org/10.1111/cogs.13180

25. *Xia, F., *Schenck, K., *Kim, D., & **Nathan, M. J.** (2022, April). When conceptualization gets moving: Exploring how directed actions complement gestural insights for generating geometric reasoning. Paper presented at the 2022 Annual Meeting of the American Educational Research Association, San Diego, CA. AERA.

26. *Xia, F., *Schenck, K. E., Swart, M. I., & **Nathan, M. J.** (2022, June). The role of action-prediction in mathematical reasoning. In *Proceedings of the 16th International Conference of the Learning Sciences-ICLS2022* (pp. 1469-1472). Hiroshima, Japan: International Society of the Learning Sciences.

27. *Xia, F., *Schenck, K. E., Swart, M. I., & **Nathan, M. J.** (2022, June). Directed actions scaffold gestural insights in geometric reasoning. In *Proceedings of the 16th International Conference of the Learning Sciences-ICLS2022* (pp. 1982-1983). Hiroshima, Japan: International Society of the Learning Sciences.

28. *Fogel, A., Swart, M., Scianna, J., Berland, M., & **Nathan, M. J.** (2021, November). Design for remote embodied learning: The Hidden Village-Online. In Rodrigo, M. M. T. et al. (Eds.), *Proceedings of the 29th International Conference on Computers in Education* (ICCE-2021). Asia-Pacific Society for Computers in Education. https://icce2021.apsce.net/proceedings/volume2/

29. *Godfrey, M., Rosser, A. A., Jung, S., Crandall, M., **Nathan, M. J.,** & Greenberg, J. A. (2021). Attending's instructional methods as exhibited during intraoperative takeovers. *Surgery, 170*(2), 446-453. doi.org/10.1016/j.surg.2021.02.022

30. *Kim, D., Swart, M. I., *Schenck, K., & **Nathan, M. J.** (2021, June). Grounded and embodied proof production: Are gestures and speech enough to produce deductive proof? In E., de Vries, Y. Hod, & J. Ahn (Eds.) *Proceedings of the 15th International Conference of the Learning Sciences - ICLS 2021* (pp. 1109-1110). Bochum, Germany: International Society of the Learning Sciences.

31. *Kirankumar, V., *Sung, H., Swart, M., *Kim, D., *Xia, F., Kwon, O. H., **Nathan, M. J.**, & Walkington, C. (2021, June). Embodied transmission of ideas: Collaborative construction of geometry content and mathematical thinking. In C. E. Hmelo-Silver, B. De Wever, & J. Oshima (Eds.), *Proceedings of the 14th International Conference on Computer-Supported Collaborative Learning - CSCL 2021* (pp. 177-180). Bochum, Germany: International Society of the Learning Sciences.

32. **Nathan, M. J.**, Soto, H., *Closser, A. H., Ottmar, E., Abrahamson, D., & Walkoe, J. (2021, October). Embodied mathematical imagination and cognition (EMIC) Research Colloquium. In Olanoff, D., Johnson, K., & Spitzer, S. M. (2021). *Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1934-1937). Philadelphia, PA.

33. **Nathan, M. J.** & Swart, M. I. (2021). Materialistic epistemology lends design wings: Educational design as an embodied process. *Educational Technology Research and Development*, *69*, 1925–1954. doi.org/10.1007/s11423-020-09856-4

    N. B. Special Issue on embodied cognition and technology for learning. T.J. Kopcha, Keri D. Valentine & Ceren Oca, Editors.

34. **Nathan, M. J.**, Walkington, C., & Swart, M. I. (2021, November). Investigating computer designs for grounded and embodied mathematical learning. In Rodrigo, M. M. T. et al. (Eds.), Proceedings of the 29th International Conference on Computers in Education (ICCE-2021). Asia-Pacific Society for Computers in Education. https://icce2021.apsce.net/proceedings/volume2/

35. *Schenck, K. & **Nathan, M. J.** (2021, June). Exploring expanded notions of mathematical reasoning: Spatial systems, anxiety, and embodiment. In A. Wichmann, H. U. Hoppe, & N. Rummel (Eds.), *General Proceedings of the 1st Annual Meeting of the International Society of the Learning Sciences 2021* (pp. 113-114). Bochum, Germany: International Society of the Learning Sciences.

36. Swart, M. I., *Kirankumar, V., *Sung, H., *Xia, F., *Kim, D., Kwon, O. H., Walkington, C., *Schenck, K., & **Nathan, M. J.** (2021, October). Embodied transmission of ideas: Mathematical thinking through collaborative construction of geometry video game content. In Olanoff, D., Johnson, K., & Spitzer, S. M. (2021). *Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1341-1345). Philadelphia, PA.

37. *Sung, H., Swart, M. I., & **Nathan, M. J.** (2021, October). Enhancing K-12 pre-service teachers' embodied understanding of the geometry knowledge through online collaborative design. In Olanoff, D., Johnson, K., & Spitzer, S. M. (2021). *Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 909-917). Philadelphia, PA.

38. Walkington, C., Gravell, J., Velazque, J., He, T., Hickey, G., **Nathan, M. J.,** & Cuevas, A. (2021, June). Collaborative virtual learning in the shAR geometry simulation environment. In A. Wichmann, H. U. Hoppe, & N. Rummel (Eds.), *General Proceedings of the 1st Annual Meeting of the International Society of the Learning Sciences 2021* (pp. 17-20). Bochum, Germany: International Society of the Learning Sciences.

39. *Xia, F., Swart, M. I., *Kim, D., & **Nathan, M. J.** (2021, April). Eliciting predictive behaviors to support embodied mathematical cognition: Socially-distanced experimentation in the time of COVID-19. Paper presented at the 2021 Annual Meeting of the American Educational Research Association, San Diego, CA (virtual). AERA.

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N. B. Proceedings publication was delayed and in modified format due to COVID-19.

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57. Walkington, C., *Chelule, G., *Woods, D., & **Nathan, M.J**. (2019). Collaborative gesture as a case of extended mathematical cognition. *Journal of Mathematical Behavior*. DOI: 10.1016/j.jmathb.2018.12.002

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59. Walkington, C., *Woods, D., **Nathan, M.J.,** *Chelule, G., & *Wang, M. (2019). Does restricting hand gestures impair mathematical reasoning? *Learning and Instruction*, *64*, 101225.

60. +Fyfe, E. R., & **Nathan, M. J.** (2018). Making "concreteness fading" more concrete as a theory of instruction for promoting transfer. *Educational Review*, 1-20.

61. **Nathan, M. J.** (2018). Do the merits of the complex systems conceptual framework of learning extend to design-for-learning guidelines? In session: *Rising Above? Implications of Complexity for Theories of Learning*. In Kay, J. and Luckin, R. (Eds.) *Rethinking Learning in the Digital Age: Making the Learning Sciences Count, 13th International Conference of the Learning Sciences (ICLS) 2018, Volume 2* (pp. 13281334). London, UK: International Society of the Learning Sciences. doi.dx.org/10.22318/cscl2018.1328

62. **Nathan, M. J.,** Walkington, C., Vinsonhaler, R., Michaelis, J., McGinty, J., Binzak, J. V., & Kwon, O., H. (2018, April). Embodied account of geometry proof, insight, and intuition among novices, experts, and English language learners. Paper presented to the 2018 Annual Meeting of the American Educational Research Association, New York, NY.

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65. Pier, E. L., Brauer, M., Filut, A., Kaatz, A., Raclaw, J., **Nathan, M. J.**, Ford C. E., & Carnes, M. (2018). Low agreement among reviewers evaluating the same NIH grant applications. *Proceedings of the National Academy of Sciences* (PNAS), DOI: 10.1073/pnas.1714379115

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of the North American Chapter of the International Group for the Psychology of Mathematics Education (p. 1287). Greenville, SC: University of South Carolina & Clemson University.

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80. *Williams-Pierce, C. *Pier, E. L., Walkington, C., +Boncoddo, R., Clinton, V., Alibali, M. W., & **Nathan, M. J.** (2017). What we say and how we do: Action, gesture, and language in proving. *Journal for Research in Mathematics Education*, *48*(3), 248-260.

81. Williams–Pierce, C., Walkington, C., Landy, D., Lindgren, R., Levy, S. T., **Nathan, M. J.**, & Abrahamson, D. (2017, June). Enabling and Understanding Embodied STEM Learning. In Smith, B. K., Borge, M., Mercier, E., and Lim, K. Y. (Eds.), *Making a Difference: Prioritizing Equity and Access in CSCL, 12th International Conference on Computer Supported Collaborative Learning (CSCL) 2017, Volume 2* (pp. 909-912). Philadelphia, PA: International Society of the Learning Sciences. ISBN (Electronic): 9780990355021

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84. +Clinton, V., Alibali, M. W., & **Nathan, M. J.** (2016). Learning about posterior probability: Do diagrams and elaborative interrogation help? *The Journal of Experimental Education*, *84*(3), 1-21. DOI: 10.1080/00220973.2015.1048847

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86. Fyfe, E. R. & **Nathan, M. J.** (2016, July). Connecting concrete and abstract representations: What is "concreteness fading" and how does it work? Fourth Annual Midwest Meeting on Mathematical Thinking (M3T). Madison, WI.

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89. **Nathan, M. J.** (2016, July). Action-cognition transduction: An embodied account of transformational proof in mathematics. Fourth Annual Midwest Meeting on Mathematical Thinking (M3T). Madison, WI.

90. **Nathan, M. J.**, Ottmar, E., Abrahamson, D., Williams-Pierce, C., Walkington, C., & Nemirovsky, R. (2016, November). Embodied mathematical imagination and cognition (EMIC) Working Group. In the *Proceedings of the 38th annual meeting of*

    the North American Chapter of the International Group for the Psychology of Mathematics Education (pp. 1690-1697). Tucson, AZ: University of Arizona.

91. **Nathan, M. J.** & Walkington, C. (November, 2016). Design of a Video Game for Promoting Embodied Mathematical Reasoning. In the *Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (p. 1558). Tucson, AZ: University of Arizona.

92. *Pier, E. L., +Raclaw, J., Ford, C. E., & **Nathan, M. J.** (2016, April). Studying the study section: How collaborative decision making and videoconferencing impacts the grant peer review process. Paper presentation to the 2016 Annual Meeting of the American Educational Research Association, Washington, DC.

93. Walkington, C. A. & **Nathan, M. J.** (2016, April). Embodied learning on any device: Geometric proof in a motion-capture video game. Paper presentation to the 2016 Annual Meeting of the American Educational Research Association, Washington, DC.

94. Clinton, V. E., Morsanyi, K., Alibali, M. W., & **Nathan, M. J.** (2015, April). Learning about probability from text and tables: Do color coding and labeling through a user-interactive interface help? Paper presentation to the 2015 Annual Meeting of the American Educational Research Association, Chicago, IL.

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    N. B. Reprinted from Scientific American Mind *2013.*

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97. *Michaelis, J. E., & **Nathan, M. J.** (2015, April). The role of feedback in interest development in an out-of-school engineering setting. Paper presentation to the 2015 Annual Meeting of the American Educational Research Association, Chicago, IL.

98. **Nathan, M. J.** & Alibali, M. W. (2015, April). Effective instructional gestures: Design principles for virtual pedagogical agents. In session The Learning at Hand: Gesture Production in Virtual Pedagogical Agents. For the SIG-Advanced Technologies for Learning. Paper presentation to the 2015 Annual Meeting of the American Educational Research Association, Chicago, IL.

99. **Nathan, M. J.**, Alibali, M. W., Nemirovsky, R., Walkington, C., & Hall, R. (November, 2015). Embodied mathematical imagination and cognition (EMIC). In the *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1352-1359). East Lansing, MI: Michigan State University.

100. **Nathan, M. J.**, +Clinton, V. E., +Cooper, J. L., & Alibali, M. W. (2015, April). Now you don't: Visual attention for illustrations during mathematical lessons. In Symposium, Scaling Up Cognitive Learning Principles to Redesign a Mathematics Curriculum for Improved Learning. Paper presentation to the 2015 Annual Meeting of the American Educational Research Association, Chicago, IL.

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105. Alibali, M. W., **Nathan, M. J**., Wolfgram, M. S., Church, R. B., *Jacobs, S. A., *Martinez, C. J., & Knuth, E. J. (2014). How teachers link ideas in mathematics instruction using speech and gesture: A corpus analysis. *Cognition and Instruction*. *32*(1), 65-100, DOI: 10.1080/07370008.2013.858161.

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108. *Michaelis, J. & **Nathan, M. J.** (2014). The role of feedback in interest development in an out-of-school engineering setting. In W. Penuel, S. A. Jurow, and K. O'Connor (Eds.), *Learning and Becoming in Practice: Proceedings of the Eleventh International Conference of the Learning Sciences* (pp. 1525-1526). Boulder, CO: University of Colorado.

109. **Nathan, M. J.** (2014, April). Modeling Activities in Integrated STEM Learning. Symposium presentation in "STEM Integration: Promises and Challenges," M. Gauvain (Organizer) to the 2014 Annual Meeting of the American Educational Research Association, Philadelphia, PA.

110. **Nathan, M. J**., Walkington, C., +Boncoddo, R., *Pier, E. L., *Williams, C. C., & Alibali, M. W. (2014). Actions speak louder with words: The roles of action and pedagogical language for grounding mathematical proof. *Learning and Instruction, 33,* 182-193. DOI: 10.1016/j.learninstruc.2014.07.001

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112. *Pier, E. L., Walkington, C., *Williams, C., +Boncoddo, R., *Waala, J., Alibali, M. W., & **Nathan**, **M. J.** (2014). Hear what they say and watch what they do: Predicting valid mathematical proofs using speech and gesture. In W. Penuel, S. A. Jurow, and K. O'Connor (Eds.), *Learning and Becoming in Practice: Proceedings of the Eleventh International Conference of the Learning Sciences* (pp. 649-656). Boulder, CO: University of Colorado.

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114. Walkington, C., +Boncoddo, R., *Williams, C., **Nathan, M. J.,** Alibali, M. W., *Simon, E., & *Pier, E. L. (2014). Being mathematical relations: Dynamic gestures support mathematical reasoning. In W. Penuel, S. A. Jurow, and K. O'Connor (Eds.), *Learning and Becoming in Practice: Proceedings of the Eleventh International Conference of the Learning Sciences* (pp. 479-486). Boulder, CO: University of Colorado.

115. Alibali, M. W., **Nathan, M. J.**, Church, R. B., Wolfgram, M. S., *Kim, S., & Knuth, E. J. (2013). Gesture and speech in mathematics lessons: Forging common ground by resolving trouble spots. *ZDM – International Journal on Mathematics Education*. *45*, 425–440. DOI 10.1007/s11858-012-0476-0 (published online 1/31/13).

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214. **Nathan, M. J.**, Koedinger, K. R., & Alibali, M. W. (2001). Expert blind spot: When content knowledge eclipses pedagogical content knowledge. In L. Chen et al. (Eds.), *Proceeding of the Third International Conference on Cognitive Science*. (pp. 644-648). Beijing, China: USTC Press.

215. **Nathan, M. J.**, Koedinger, K. R., & Alibali, M. (2001, April). The expert blind spot: When content knowledge and pedagogical content knowledge collide. Presentation to the American Educational Research Association annual meeting. Seattle, WA..

216. **Nathan, M. J.** & *Robinson, C. (2001). Considerations of learning and learning research: Revisiting the "Media effects" debate. *Journal of Interactive Learning Research*, *12*, 69-88. (formerly *Journal of Artificial Intelligence and Education*).

217. *Masarik, D. K., and **Nathan, M. J.** (2000, April). How student discourse can influence student learning and classroom instruction: A case study of pattern generalization in a sixth grade mathematics class. Presentation to the American Educational Research Association annual meeting. New Orleans, LA.

218. **Nathan, M. J.** and Kalmon, S. (2000, April). The model for sustainable professional development. Presentation to the American Educational Research Association annual meeting. New Orleans, LA.

219. **Nathan, M. J.**, and Koedinger, K. R. (2000). An investigation of teachers' beliefs of students' algebra development. *Cognition and Instruction*, *18*(2), 209-237.

220. **Nathan, M. J.**, and Koedinger, K. R. (2000). Teachers' and researchers' beliefs about the development of algebraic reasoning. *Journal for Research in Mathematics Education*, *31*, 168-190.

221. **Nathan, M. J.**, and Koedinger, K. R. (2000). Moving beyond teachers' intuitive beliefs about algebra learning. *Mathematics Teacher*, *93*, 218-223.

222. **Nathan, M. J.** and *Long, S. (2000, April). Mathematics textbooks: Are they the seeds of teachers' misconceptions? Presentation to the American Educational Research Association annual meeting. New Orleans, LA.

223. Goldman, S. R., Zech, L. K., Biswas, G., Noser, T., Batemen, H., Bransford, J., Crews, T., Moore, A., **Nathan, M. J.**, & Owens, S. (1999). Computer technology and complex problem solving: Issues in the study of complex cognitive activity. *Instructional Science*, *27*, 235-268.

224. Koedinger, K. R., Alibali, M., & **Nathan, M. J.** (1999, April). A developmental model of students' early algebra competency. Presentation to the American Educational Research Association annual meeting. Montreal, Canada.

225. **Nathan, M. J.** (1999, April). An instructional theory for early algebra that incorporates research on student thinking, teacher beliefs, and classroom interactions. Presentation to the American Educational Research Association annual meeting. Montreal, Canada.

226. **Nathan, M. J.** (1998). Knowledge and situational feedback in a learning environment for algebra story problem solving. *Interactive Learning Environments*, *5*, 135-159.

227. **Nathan, M. J.**, Knuth, E., & *Elliott, R. (1998, April). Analytic and social scaffolding in the mathematics classroom: One teacher's changing practices. Presentation to the American Educational Research Association annual meeting. San Diego CA.

228. **Nathan, M. J.**, *Elliott, R., Knuth, E., & French, A. (1997, April). Self-reflection on teacher goals and actions in the mathematics classroom. Presentation to the American Educational Research Association annual meeting. Chicago, IL.

229. **Nathan, M. J.**, Koedinger, K., and Tabachneck, H. T. (1997). Teachers' and researchers' beliefs of early algebra development. *Proceedings of the Nineteenth Annual Conference of the Cognitive Science Society*, August, 1997 (pp. 554-559). Palo Alto, CA. Hillsdale, N.J.: Erlbaum.

230. **Nathan, M. J.** (1996, April). Computer-based tutoring in support of human tutoring and learner agency. Presentation to the American Educational Research Association (AERA) annual meeting. New York City, NY.

231. **Nathan, M. J.** (1996, April). The embodiment of design principles for situationally dynamic tools to foster mathematical story comprehension and problem solving (interactive poster). Presentation to the American Educational Research Association (AERA) annual meeting. New York City, NY.

232. **Nathan, M. J.** & *Elliott, R. (1996). Evaluating models of practice: Reform-based mathematics at the middle school level. In *Proceedings of the Psychology of Mathematics Education - North America 18 (PME) annual meeting*. (p. 145). Psychology of Mathematics Education: Author.

233. **Nathan, M. J.**, Koedinger, K., and Tabachneck, H. T. (1996, April). Difficulty factors in arithmetic and algebra: The disparity of teachers' beliefs and students' performances (roundtable discussion). Presentation to the American Educational Research Association (AERA) annual meeting. New York City, NY.

234. Crews, T., Biswas, G., Bransford, J. D., Goldman, S. R., **Nathan, M. J.**, & Varma, S. (1995). AdventurePlayer: macrocontext plus microworlds. In *Proceedings of the Seventh World Conference on Artificial Intelligence in Education, AI-ED'95*, August 1995. Washington, D.C. Charlottesville, VA: AACE.

235. **Nathan, M. J.** (1995, April). A discussion on "The Multimedia Journal Article" format as a new technology for reporting research and evaluation projects (panel chair, organizer, and presenter). American Educational Research Association (AERA) annual meeting. (with J. Hawkins, B. J. Hood, R. Hall, L. Erlbaum, & E. Soloway).

236. Owens, S., Biswas, G., **Nathan, M. J.**, Zech, L., Bransford, J. D., & Goldman, S. R. (1995). Smart Tools: A multi-representational approach to teaching functional relations. (p. 589) In *Proceedings of the Seventh World Conference on Artificial Intelligence in Education, AI-ED'95* (Washington, D.C.) Charlottesville, VA: AACE.

237. Tabachneck, H. T., Koedinger, K., & **Nathan, M. J.** (1995). A cognitive analysis of the task demands of early algebra. *Proceedings of the Seventeenth Annual Conference of the Cognitive Science Society* (pp. 397-402). Hillsdale, N.J.: Erlbaum.

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239. **Nathan, M. J.**, *Mertz, K. & *Ryan, R. (1994, April). Learning through selfexplanation of mathematics examples: effects of cognitive load (poster). Presentation to the American Educational Research Association (AERA) annual meeting. (Also ERIC Document ED372095.)

240. Tabachneck, H. T., Koedinger, K., & **Nathan, M. J.** (1994). Toward a theoretical account of strategy use and sense-making in mathematics problem solving. *Proceedings of the Sixteenth Annual Conference of the Cognitive Science Society* (pp. 836-841). Hillsdale, N.J.: Erlbaum.

241. Kintsch, W., Britton, B.K., Fletcher, C.R., Kintsch, E., Mannes, S.M., & **Nathan, M. J.** (1993). A comprehension-based approach to learning and understanding. *The Psychology of Learning and Motivation, 30*, 165-214.

242. Schwarz, B. B. & **Nathan, M. J.** (1993). Assessing conceptual understanding of arithmetic structure and language. In *Proceedings of The Fifteenth Annual Meeting of The Cognitive Science Society* (pp. 912-917). Boulder, CO. Hillsdale, N. J.: Erlbaum.

243. **Nathan, M. J.** (1992). Interactive depiction of mathematical constraints can increase students word problem solving. In W. Geeslin and K. Grahm (Eds.), *Proceedings of the Sixteenth Psychology of Mathematics Education (PME) Conference,* Vol. 2 (pp. 160-169). Durham, NH: Program Committee of the 16th PME.

244. **Nathan, M. J.**, Kintsch, W., & Young, E. (1992). A theory of algebra word problem comprehension and its implications for the design of computer learning environments. *Cognition and Instruction, 9*(4). 329-389.

245. **Nathan, M. J.** (1991). A simple learning environment improves mathematical reasoning. *Intelligent Tutoring Media. 2*(3&4). 101-111.

246. Laufmann, S., **Nathan, M. J.**, & Blumenthal, R. L. (1991). Communication and cooperation among coarse-grained, distributed agents. *Proceedings of the AAAI Workshop on Cooperation Among Heterogeneous Intelligent Systems* (pp. 1-13). Anaheim, CA: AAAI.

247. **Nathan, M. J.** (1990). Empowering the student: Prospects for an unintelligent tutor for word algebra problem solving. J. Carrasco and J. Whiteside (Eds.) *Proceedings of Computer-Human Interaction (CHI)* (pp. 407-414). Association of Computing Machinery.

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251. Magee, M. and **Nathan, M.** (1987). A viewpoint-independent modeling approach to object recognition. *IEEE Journal of Robotics and Automation, 3*(4). 351-356.

252. Magee, M. and **Nathan, M.** (1987). Spatial reasoning, sensor repositioning and disambiguation in 3D model based recognition. In A. Kak & S. Chen (Eds.) *Spatial Reasoning and Multi-sensor Fusion* (pp. 262-271). Los Altos, CA: Kaufman.

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256. **Nathan, M.** & Magee, M. (1986). Correspondence, partial matching and image understanding. *Proceedings of SPIE Cambridge Symposium on Recent Advances in Intelligent Robotics* (pp. 275-283). Bellingham, WA: SPIE.

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258. **Nathan, M. J.** (1985). Hypothesis generation in a theorem proving based pattern recognition system. *Proceedings of SPIE Symposium on Intelligent Robotics and Computer Vision* (pp. 170-176). Bellingham, WA: SPIE.

Scholarly Book Reviews

259. *Pier, E. L. & **Nathan, M. J.** (2016). A review of 'Mathematics and the body: Material entanglements in the classroom.' *Journal for Research in Mathematics Education, 47*(4), 423-427.

260. *Felton, M. D. & **Nathan, M. J.** (2009). Exploring Sfard's commognitive framework of thinking as communicating: A review of 'Thinking as Communicating: Human Development, the Growth of Discourses, and Mathematizing.' *Journal for Research in Mathematics Education*, *40* (5), 571 – 576.

261. **Nathan, M. J.** (2007). Enriching the Brain: How to Maximize Every Learner's Potential (book review). *Science Education*, *91*, 341-344.

262. **Nathan, M. J.** (2006). Reflecting on the role of the hand, head and soul of America: The mind at work. *Mind, Culture and Activity*, *13*(1), 74-77.

Book Chapters

263. **Nathan, M. J.** (In press). Advancements of grounded and embodied mathematical reasoning: Theory, technology, and research methods. In L. Shapiro & S. Spaulding (Eds.), *Routledge Handbook of Embodied Cognition, Second Edition*. New York: Routledge.

264. **Nathan, M. J.** & Sawyer, K. (2022). Foundations of Learning Sciences. In K. Sawyer (Ed.). *The Cambridge Handbook of the Learning Sciences* (Third Edition) (pp. 27-52). Cambridge, England, UK: Cambridge University Press. ISBN-13: 978-1108744669

265. *Schenck, K., Walkington, C., & **Nathan, M. J.** (2022). Groups that move together, prove together: Collaborative gestures and gesture attitudes among teachers performing embodied geometry. In S. Macrine and J. Fugate (Eds.) *Movement matters: How embodied cognition informs teaching and learning* (pp. 131-145). MIT Press.

266. **Nathan, M. J.** & Alibali, M. W. (2021). An embodied theory of transfer of mathematical learning. In Charles Hohensee and Joanne Lobato (Eds.) *Transfer of Learning: Progressive Perspectives for Mathematics Education and Related Fields* (pp. 27-58). Springer.

267. Alibali, M. W. & **Nathan, M. J.** (2018). Embodied cognition in learning and teaching: Action, observation, and imagination. In F. Fischer, S. Goldman, C. Hmelo-Silver & P. Riemann (Eds.), *International Handbook of the Learning Sciences* (pp. 75-85). New York, NY: Routledge/ Taylor & Francis.

268. **Nathan, M. J.** (2017). One function of gesture is to make new ideas: Evidence for reciprocity between action and cognition. In R. B. Church, M. W. Alibali & S. D. Kelly, (Eds.) *Why*

gesture? How the hands function in speaking, thinking and communicating. (pp. 175-196). Philadelphia, PA: John Benjamins Publishing Company. doi.org/10.1075/gs.7.09nat

269. **Nathan, M. J.**, Alibali, M. W., & Church, R. B. (2017). Making and breaking common ground: How teachers use gesture to foster learning in the classroom. In R. B. Church, M. W. Alibali & S. D. Kelly, (Eds.) *Why gesture? How the hands function in speaking, thinking and communicating*. (pp. 285-316). Philadelphia, PA: John Benjamins Publishing Company. doi.org/10.1075/gs.7.14nat

270. Clinton, V., Cooper, J.L., *Michaelis, J., Alibali, M.W., & **Nathan, M.J.** (2017). How revisions to mathematical visuals affect cognition: Evidence from eye tracking. In C. Was, F.J. Sansosti, & B.J. Morris (Eds.) *Eye-tracking technology applications in educational research*, (pp. 195-218). Hershey, PA: IGI Global.

271. **Nathan, M. J.,** Rummel, N., & Hay, K. E. (2016). Growing the Learning Sciences: Brand or big tent? Implications for graduate education. In M. A. Evans, M. J. Packer, and R. K. Sawyer (Eds.) *Reflections on the Learning Sciences.* (pp. 191-209). New York: Cambridge University Press. ISBN: 9781107070158.

272. **Nathan, M. J.** & Sawyer, K. (2014). Foundations of Learning Sciences. In K. Sawyer (Ed.). *The Cambridge Handbook of the Learning Sciences* (Second Edition) (pp. 2143). Cambridge, England, UK: Cambridge University Press.

273. **Nathan, M. J.** (2014). Grounded mathematical reasoning. In L. Shapiro (Ed.). *The Routledge Handbook of Embodied Cognition* (pp. 171-183). New York: Routledge.

274. *Prevost, A. C., **Nathan, M. J.**, Phelps, L. A., *Atwood, A. K., *Tran, N. A., *Oliver, K., & *Stein, B. (2014). Academic connections in precollege engineering contexts: The intended and enacted curricula of Project Lead the Way™ and beyond. In Strobel, J., Purzer, S. & Cardella, M. (Eds.) *Engineering in Pre-College Settings: Research into Practice* (pp. 211-230). West Lafayette, IN: Purdue University Press.

275. +Walkington, C. A., **Nathan, M. J.**, Wolfgram, M., Alibali, M. W., & *Srisurichan, R. (2014). Bridges and barriers to constructing conceptual cohesion across modalities and temporalities: Challenges of STEM integration in the precollege engineering classroom. In Strobel, J., Purzer, S. & Cardella, M. (Eds.) *Engineering in Pre-College Settings: Research into Practice* (pp. 183-209). West Lafayette, IN: Purdue University Press.

276. Alibali, M. W., **Nathan, M. J.** & *Fujimori, Y. (2011). Gestures in the classroom: What's the point? In N. L. Stein & S. W. Raudenbush (Eds.) *Developmental Cognitive Science Goes to School* (pp. 219-234). New York: Routledge.

277. **Nathan, M. J.**, & Alibali, M. W. (2011). How gesture use enables intersubjectivity in the classroom. In G. Stam & M. Ishino (Eds.), *Integrating gestures: The interdisciplinary nature of gesture* (pp. 257-266). Amsterdam: John Benjamins.

278. **Nathan, M. J.** (2010). Technology supports for acquiring mathematics. In: Penelope Peterson, Eva Baker, & Barry McGaw, (Editors), *International Encyclopedia of Education.* Vol. 8, pp. 172-183. Oxford: Elsevier.

279. **Nathan, M. J.**, *Kim, S., & Eilam, B. (2009). Methodological considerations in the study of intersubjectivity among participants of a dialogic mathematics classroom. In Schwarz, B. B., Hershkowitz, R., & Dreyfus, T. (Eds.) *Transformation of knowledge through classroom interaction* (pp. 244-260). *New Perspectives on Learning and Instruction* Book Series. New York: Routledge.

280. **Nathan, M. J.** (2008). An embodied cognition perspective on symbols, grounding, and instructional gesture. In DeVega, M., Glenberg, A, M. & Graesser, A. C. (Eds.) *Symbols, Embodiment and Meaning: A Debate* (pp. 375-396). Oxford, England: Oxford University Press.

281. Alibali, M. W. & **Nathan, M. J.** (2007). Teachers' gestures as a means of scaffolding students' understanding: Evidence from an early algebra lesson. In Goldman, R., Pea, R., Barron, B. J., and Derry, S. (Eds.) *Video Research in the Learning Sciences* (pp. 349-365). Mahwah, NJ: Erlbaum.

282. **Nathan, M. J.** (2007). To disagree, we must also agree: How intersubjectivity structures and perpetuates discourse in a socially mediated mathematics learning environment. In B. B. Schwarz and T. Dreyfus (Eds.) *Proceedings from the Workshop on Guided Construction of Knowledge in Classrooms* (pp. 27-37). Hebrew University Jerusalem, Israel: Authors. Available at http://escalate.org.il/construction_knowledge/eng_intro.htm

283. French, A. & **Nathan, M. J.** (2006). Under the microscope of research and into the classroom: Reflections on early algebra learning and instruction. In J. O. Masingila (Ed.) *Teachers Engaged in Research* (pp. 49-68). Greenwich, CT: Information Age Publishing.

284. **Nathan, M. J.** (2002). Mathematics learning: Algebra. In James W. Guthrie (Ed.) *Encyclopedia of Education, Second Edition* (Vol. 5, pp. 1542-1545). New York: Macmillan Reference USA.

285. Cognition and Technology Group at Vanderbilt (1997). *The Jasper Project: Lessons in Curriculum, Instruction, Assessment, and Professional Development.* Mahwah, NJ: Erlbaum.

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287. Schwarz, B. B., **Nathan, M.** & Resnick, L. B. (1996). Acquisition of meaning for arithmetic structure with the Planner. In S. Vosniadou, E. De Corte, R. Glaser, & H. Mandl (Eds.), *International Perspectives on the Design of Technology-Supported Learning Environments* (pp. 61-80). Hillsdale, NJ: Erlbaum.

288. **Nathan, M. J.** & Resnick, L. B. (1994). Less can be more: Unintelligent tutoring based on psychological theories and experimentation. In S. Vosniadou, E. De Corte, & H. Mandl (Eds.), *Technology-based Learning Environments: Psychological and Educational Foundations*, NATO ASI Series F, Computer and Systems Sciences, Vol. 137 (Sub-series on Advanced Educational Technology). (pp. 183-192). New York: Springer Verlag.

289. **Nathan, M. J.** (1991). A simple learning environment improves mathematical reasoning. In H. S. Nwana (Ed.), *Mathematical Intelligent Learning Environments* (pp. 162-186). Intellect Books: Oxford. (Reprinted from *Intelligent Tutoring Media. 2*(3&4). 101-111.)

Invited Presentations

1. **Nathan, M. J.** (2023, Apr. 12). "Time Management as a Professor." Presentation to the AERA Division C New Faculty Mentoring Program. (Organizer: Doug Lombardi and Daniel Dinsmore).

2. **Nathan, M. J.** (2022, Dec. 3). "What is Learning Sciences and Why it Matters for Education." Talk to *A II Escola Anual de Ciências da Aprendizagem* / The Second Learning Sciences School for Brazilian Scholars. (Organizer: Cassia Fernandez). https://www.cienciasdaaprendizagem.org/escola-anual-2022-2023

3. **Nathan, M. J.** (2022, Sep. 29). "Can Augmented Intelligence Systems Mitigate the Risks that Disembodied AI Poses for Education?" Talk to the Augmented Intelligence (AugInt) Workshop (Organizers: Robert L. Goldstone, Mirta Galesic, Gautam Biswas, Marina Dubova). Video is available at https://youtu.be/kA_rOjxBrJo

4. **Nathan, M. J.** (2022, Mar. 25). "Scale-Down Methodology for Designing Technology for Embodied Interactions." Talk for the Future Learning Initiative Colloquium, at the Eidgenössische Technische Hochschule (ETH) Zürich, Zürich, Switzerland (Virtual).

5. **Nathan, M. J.** (2022, Mar. 16). "Design for Promoting Grounded and Embodied Learning." Lunch and Learn group at the University of Michigan (Host: Rebecca M. Quintana, PhD). Ann Arbor, MI (Virtual).

6. **Nathan, M. J.** (2021, Dec.). "Instructional Gestures: Handy Ways to Promote Comprehension and Learning." Talk for the Seminar Series Enseñando con el Cerebro en Mente / Teaching with the Brain in Mind, for educational practitioners. Universidad de Chile, Santiago (Virtual).

7. **Nathan, M. J.** & Alibali, M. W. (2021, Nov.). A conversation about "Foundations of embodied learning: a paradigm for education," hosted by A Room of One's Own bookstore (Madison, WI). https://www.crowdcast.io/e/mitchell-nathan-author/1

8. **Nathan, M. J.** (2021, Nov.). "Foundations of embodied learning – a paradigm for education," to the *Creative Language Technologies* Podcast, hosted by Dr. Roxana Girju. https://player.fm/series/2975513/308014265

9. **Nathan, M. J.** (2021, Nov.). "(Practice to) Research to Practice: Embodied Cognition and the Design of Educational Technology." Presentation to Education Policy Across the Disciplines, University of Wisconsin-Madison. Hosted by Dr. Martha Wagner Alibali.

10. **Nathan, M. J.** (2021, Sep.). "Assessing the embodied mind," to NSF-DUE Workshop, Embodied Mathematical Imagination and Cognition: Professional Development for Undergraduate Mathematics Instructors. Colorado State University, Ft. Collins, CO (Virtual). September 26, 2021.

11. **Nathan, M. J.** (2021, May). Discussion of "*Foundations of Embodied Learning: A Paradigm for Education*," to Montclair State University, Dr. Steven Greenstein's doctoral seminar on advanced topics in mathematics education research. May 18, 2021.

12. **Nathan, M. J.** (2021, Feb.). "Instructional gestures: Handy ways to promote comprehension and learning," Presentation to UW-Madison's Annual Teaching & Learning Symposium, Office of the Vice Provost for Teaching & Learning. Madison, WI (Virtual). February 3, 2021.

13. **Nathan, M. J.** (2021, Jan.) Scale-down methodology: Scaling-up educational innovation. Talk to Santa Fe Institute: Education, Equity & Technology, January 19, 2021.

14. **Nathan, M. J.** (2020, Oct.). The future of embodied design for mathematics teaching and learning. Virtual panel presentation hosted by embodiedmathematics.com. [EMIC Virtual #2]

15. **Nathan, M. J.** (2020, July). Scale-down methodology: A complex systems approach to scaling up educational innovation. Presentation to the Teachers-as-Learners Program, James S. McDonnell Foundation.

16. **Nathan, M. J.** (2020, Jun) Embodied mathematical imagination and cognition: Professional development for undergraduate mathematics instructors. University of Northern Colorado.

17. **Nathan, M. J.** (2020, Jun). Instructional gestures for classrooms and on-line mathematics learning in the time of COVID-19. Panel presentation to the EMIC community and public. www.embodiedmathematics.com/emic-virtual

18. **Nathan, M. J.**, Swart, M. I, Xia, F., & Kim, D. (2020, May) It's the gesture that counts: How gestures contribute to effective instruction. The annual Teaching and Learning Symposium: Lifelong Learning (and Unlearning) as Teachers. University of Wisconsin-Madison.

19. **Nathan, M. J.** (2020, May) The Crisis of Complexity in Educational Design. Summit on AI and Educational Futures. University of Wisconsin-Madison.

20. **Nathan, M. J.** (2019, Oct.) Educating the embodied mind. Educational Psychology Department Colloquium.

21. **Nathan, M. J.** (2018, Feb.) Children's invented solution strategies as a source of bridging instruction for introductory algebra. University of Maryland.

22. **Nathan, M. J.** (2018, Feb.) Integrating STEM into the K-12 classroom. Michigan State University.

23. **Nathan, M. J.** (2017, June) Publishing in the Learning Sciences: A journal writers' workshop. At the international conference on Computer Supported Collaborative Learning, Phila., PA.

24. **Nathan, M. J.** (2017, May) Reconnecting the body to mathematics learning and instruction. Michigan State University, School of Education, East Lansing, MI.

25. **Nathan, M. J.** (2017, May) Using our bodies to do and understand mathematics. East High School Mathematics Dept., Madison, WI.

26. **Nathan, M. J.** (2017, April) Work-Life balance for faculty in education research. American Educational Research Association, Division C Graduate Student Seminar, San Antonio, TX.

27. **Nathan, M. J.** (2016, October). Keynote: The future of the Learning Sciences. Talk given to the Inaugural Learning Sciences Graduate Student (LSGS) Conference, University of Illinois-Chicago.

28. **Nathan, M. J.** (2016, May). Action-Cognition Transduction: A proposed mechanism for enhancing mathematical intuition during proof production. Invited talk to University of Chicago - Center for Gesture Sign and Language (CGSL), Chicago, IL.

29. **Nathan, M. J.** (2016, February). Research in Mathematics Education, Research-to-Practice Conference Keynote: "Integrating STEM into the K-12 mathematics classroom," Southern Methodist University, Dallas, TX.

30. **Nathan, M. J.** (2015, February). AAAS Presidential Invited Session: Human Mathematical Abilities - From Intuition to the Classroom and Back. American Association for the Advancement of Science (Section J, Psychology), with J. L. McClelland (Organizer), E. S. Spelke, P. J. Kellman, and B. D. McCandliss. San Jose, CA.

31. **Nathan, M. J.** (2015, February). Body-based resources when reading-to-learn in science: gestures and model enactment for stem literacy. Learning and the Brain Conference. San Francisco, CA.

32. **Nathan, M. J.** (2014, November). Plenary speaker, "The Science of Learning." International Mind, Brain and Education Society (IMBES), Fort Worth, TX.

33. **Nathan, M. J.** (2014, October). Rising to the challenges of integrated STEM education: A response from the field of learning sciences. Colloquium series "Greater than the Sum of its Parts? Integrated Approaches to STEM Education in PreK-16," University of Delaware School of Education.

34. **Nathan, M. J.** (2014, October). Keynote to the Virginia Military Institute: Leading your students to make connections in integrative STEM. Workshop on "Engineering Ingenuity."

35. **Nathan, M. J.** (2014, May). Embodiment in mathematics teaching and learning: A view from students' and teachers' gestures. Invited talk to the Learning Sciences Lab (LSL) at the National Institute of Education (NIE) of Singapore.

36. **Nathan, M. J.** (2014, March). The Role of Formalisms in Mathematical Reasoning and Education. Latin American School for Education, Cognitive and Neural Sciences, Punta del Este, Uruguay.

37. **Nathan, M. J.** (2013, October). The Role of Gestures in Inference Making and the Enactment of Mental Models. University of Chicago, Dept. of Psychology. (Host: Susan Goldin-Meadow)

38. **Nathan, M. J.** (2013, May). If we are 'wired' to learn, then why do we often struggle with learning? Founders' Day Keynote Presentation. Wisconsin Alumni Association (Washington County), University of Wisconsin.

39. **Nathan, M. J.** (2013, April). Embodied Cognition: What It Means to Know and Do Mathematics. Keynote presentation to the National Council of Teachers of Mathematics (NCTM) Annual Meeting (Denver, CO)

40. Edwards, L., **Nathan, M. J.**, & Nemirovsky, R. (2013, March). Embodied cognition and mathematical reasoning: Panel discussion for the Research Pre-Session and the Annual Meeting of the National Council of Mathematics Teachers (Denver).

41. **Nathan, M. J.** (2013, March). The Transition from Arithmetic to Algebraic Reasoning: The Role of Language and Action. The 3rd Latin American School for Education, Cognitive and Neural Sciences (Ilha de Comandatuba, Bahia, Brazil).

42. **Nathan, M. J.** (2013, Jan). STEM Education in the Classroom: Rising to the Challenges. Keynote Address for the STEM Education Initiative, Institute for the Promotion of Teaching Science and Technology (IPST), Ministry of Education, Bangkok, Thailand.

43. **Nathan, M. J.**, (2012, May). Scaling Down Educational Research on Mathematical Learning and Instruction. University of Indiana, Learning Sciences Spring Colloquium Series.

44. Pearson, G., McGrath, E., **Nathan, M. J.**, & Sanders, M. (2012, April). Panel discussion: Developing a research agenda for iSTEM: Update on a National Academies Study. Second P-12 Engineering and Design Education Research Summit, Washington, D.C.

45. Bruer, J. T., Klahr, D., Yaron, D., & **Nathan, M. J.** (2012, March). Panel presentation and open discussion: A bridge not-too-far: Cognitive neuroscience and education. The 2nd Latin American School for Education, Cognitive and Neural Sciences, El Calafate, Argentina.

46. **Nathan, M. J.** (2012, March). The Transition from Arithmetic to Algebraic Reasoning: The Role of Language and Action. The 2nd Latin American School for Education, Cognitive and Neural Sciences, El Calafate, Argentina.

47. **Nathan, M. J.** (2012, February). Gesture as Model Enactment. Department of Psychology. University of California-Santa Barbara.

48. **Nathan, M. J.** (2011, October). STEM Education and the Learning Sciences. Presentation to Educational Testing Services, Princeton, New Jersey.

49. **Nathan, M. J.** (2011, April). Taking the Research to the Classroom: Reframing the Challenges. Presentation to the Oklahoma Education Forum with the Oklahoma Association of Colleges of Teacher Education and State Education Leaders. Topic: Teacher Effectiveness: Using Research to Improve Student Learning. Sponsored by Edvance Research, Inc. Oklahoma City, OK.

50. **Nathan, M. J.** (2011, March). The Transition from Arithmetic to Algebraic Reasoning. The Latin American School for Education, Cognitive and Neural Sciences, Universidad de Chile, San Pedro De Atacama, Chile.

51. **Nathan, M. J.** (2010, May). Rising to the challenge of STEM education: Implications for Teaching. Presentation to the Region 11 (Minnesota) Math and Science Teacher Academy, University of Minnesota.

52. **Nathan, M. J.** (2010, April). What Is Engineering Practice and How Do Students Learn It? Presentation to the University of Wisconsin-Madison College of Engineering.

53. Halverson, E., & **Nathan, M. J.** (2010, April). Curriculum Design: The Backwards Design Process. Presentation to the University of Wisconsin-Madison School of Medicine and Public Health Annual "Medical Education Day."

54. **Nathan, M. J.** (2010, February). Rising to the challenge of STEM education. Keynote address to the opening ceremony of the University of Minnesota STEM Education Center, College of Education and Human Development.

55. **Nathan, M. J.** (2010, January). Conducting Multidisciplinary Research in Engineering Education. Presentation to the Multidisciplinary Program in Education Sciences, Learning Sciences Program, School of Education, Northwestern University.

56. **Nathan, M. J.** (2009, February). Understanding and cultivating algebraic reasoning. Lawrence University (Appleton, WI) Science Hall Colloquium Series, with co-sponsorship from the Education Department.

57. **Nathan, M. J.** (2008, February). Expert Blind Spot in teacher cognition. Presentation to the UTeach Discovery Learning Speaker Series, University of Texas at Austin.

58. **Nathan, M. J.** (2007, December). Gesture and materialistic epistemologies in reasoning and scientific discovery. Presentation to the Center for Advanced Studies– Behavior Sciences, Palo Alto, CA.

59. **Nathan, M. J.** (2007, June). Scaling up through knowledge accumulation. Presentation to the National Science Foundation, Arlington, VA.

60. **Nathan, M. J.** (2007, March). Expert Blind Spot in teacher cognition. Presentation to the Cognitive Psychology Brown Bag Series, University of Wisconsin-Madison.

61. **Nathan, M. J.** (2007, February). How intersubjectivity structures and perpetuates discourse in a socially mediated mathematics learning environment. Presentation to the Workshop on Guided Construction of Knowledge in Classrooms at Hebrew University Jerusalem, Israel. Hosted by B. B. Schwarz and T. Dreyfus.

62. **Nathan, M. J.** (2007, January). To disagree, we must also agree: How intersubjectivity structures and perpetuates discourse in a mathematics classroom. Presentation to the University of Haifa School of Education, Mount Carmel, Haifa, Israel.

63. **Nathan, M. J.** (2007, January). Expert Blind Spot in teacher cognition. Presentation to the University of Haifa Mathematics Education Program, Mount Carmel, Haifa, Israel.

64. **Nathan, M. J.** (2006, December). To disagree, we must also agree: How intersubjectivity structures and perpetuates discourse in a mathematics classroom. Presentation to the University of Wisconsin Learning Sciences Colloquium.

65. **Nathan, M. J.** (2006, June). Learning sciences research at the University of Wisconsin. Presentation to the WCER 10-year Review Panel. Wisconsin Center for Education Research, University of Wisconsin, Madison, WI.

66. **Nathan, M. J.** (2006, May). Learning science and the science of learning, Wisconsin Symposium on Human Biology, University of Wisconsin, Madison, WI.

67. **Nathan, M. J.** (2006, March). Research in the U. S. on learning and teaching in mathematics and science. Invited talk to the Research Institute of Science Education at Guangxi Normal University, China. Hosted by Prof LUO Xingkai, Prof of Physics and Director of the Research Institute of Science Education.

68. **Nathan, M. J.**, (2005, December). Symbols and grounding in instructional settings. Presentation to "Symbols, Embodiment, and Meaning: A Workshop and Debate." December 16-18, 2005, University of La Laguna, Tenerife, Spain. Hosted by: Manuelo DeVega, Art Glenberg, and Art Graesser.

69. **Nathan, M. J.**, (2005, October). Teachers' use of grounded communication. Presentation to the School of Education, University of Massachusetts-Amherst. Hosted by Prof. John Clement.

70. **Nathan, M. J.**, (2005, September). Further results supporting the transition from arithmetic to algebraic reasoning. Poster presentation at the Interagency Education Research Initiative (IERI) Meeting, Washington, DC.

71. **Nathan, M. J.** & Halverson, E. (2005, June). How Students Learn: Thinking, Teaching and Instructional Design. Presentation to the University of Wisconsin-Madison Teaching Academy.

72. **Nathan, M. J.**, (2004, September). Supporting the transition from arithmetic to algebraic reasoning. Poster presentation at the Interagency Education Research Initiative (IERI) Meeting, Washington, DC.

73. **Nathan, M. J.** (2003, June). Technology's *other* role in SMET education: How technology design and use can support science and mathematics education (and why we tend to dismiss such approaches). School of Education and Social Policy, Northwestern University.

74. **Nathan, M. J.** (2003, February). Expert Blind Spot in teacher cognition. University of Illinois-Chicago, Cognitive Psychology Department.

75. **Nathan, M. J.** (2003, February). The formal and the physical: Contrasting views of conceptual development in science learning. University of Wisconsin—Madison Developmental Psychology Brown Bag Series.

76. **Nathan, M. J.** (2002, December). Discussant for "What do we know and need to know about facilitated online learning for teacher professional development." (Sharon Derry, Chair). Wisconsin Center for Education Research at the University of Wisconsin— Madison.

77. **Nathan, M. J.** (2002, October). Discussion of 'Teacher education and technology use within the STEP Project'. (Cindy Hmelo-Silver & Sharon Derry, Chairs). Invited discussant for the *International Conference on the Learning Sciences*. (Seattle).

78. **Nathan, M. J.**, Eisenberg, M., Schick, B. (2001, November). The evolution of a theory of manipulatives design intended to cultivate abstract reasoning in mathematics: A multidisciplinary conversation. Part of the "Converging on Cognition, University of Colorado Institute of Cognitive Science.

79. **Nathan, M. J.** (1995, November). Comprehension processes during mathematical reasoning: What it means for classroom and computer-based learning environments. Presentation to the Cognitive Science and Technology Seminar Series, University of Northern Colorado, Greeley, CO.

80. **Nathan, M. J.** (1995, October). Comprehension processes during mathematical reasoning. Presentation to the Institute of Cognitive Science, University of Colorado.

81. **Nathan, M. J.** (1993, August). Toward a comprehension-based model of problem-solving competence. German Research Center for Artificial Intelligence (DFKI), Kaiserslautern, Germany.

82. **Nathan, M. J.** (1992, November). Situation models as a vehicle for sense-making. The Artifacts and Sense-Making Group, University of California Berkeley Graduate School of Education.

83. **Nathan, M.** (1992, January). Can we assess the assessments? Presentation to The New Standards Project Advisory Board Meeting on Language Arts (San Francisco).

84. **Nathan, M. J.** (1990, April). A comprehension-based approach to learning and instruction. Invited Address to the American Educational Research Association, 1990 Annual Meeting (AERA Division C). Co-presenter with W. Kintsch, B. Britton and S. Mannes. Boston, MA.

85. **Nathan, M. J.** (1989, June). A theory of problem comprehension. Presentation to The University of Bern, Switzerland, Department of Educational Psychology.

86. **Nathan, M.** (1985, March). Robotic vision: Theory and engineering applications. Presentation to the Colorado School of Mines, Department of Engineering.

87. **Nathan, M. J.** (1985, November). Machine vision and machine knowledge. University of Colorado (Denver), Department of Mathematics (Prof. H. Greenberg).

Paper and Panel Presentations at Professional Meetings (unprinted)

1. **Nathan, M. J.** (2019, May). Embodied Meaning & Abstraction in Mathematics: Looming Questions. Presentation to National Science Foundation Synthesis and Design Workshop: The Future of Embodied Design for Mathematical Imagination and Cognition (May 20-22, 2019). Madison, WI.

2. Alibali, M. W., **Nathan, M. J.**, Popescu, V. & *Yeo, A. (2016, July). Effective Instructional Gestures: Design Principles for Virtual Pedagogical Agents. Symposium presentation to the International Society for Gesture Studies (ISGS) Seventh International Conference. Paris, France.

3. **Nathan, M. J.** (2016, July). Symposium Organizer: Gesture production in virtual pedagogical agents. Symposium presentation to the International Society for Gesture Studies (ISGS) Seventh International Conference. Paris, France.

4. & Church, R. B. (2016, July). Instructional gestures can resolve the fundamental tension between making and breaking common ground during classroom discourse Oral presentation to the International Society for Gesture Studies (ISGS) Seventh International Conference. Paris, France.

5. Alibali, M. W., *Yeo, A., +Lockwood, E., *Crooks, N., & **Nathan, M. J.** (2014, July). How instructors connect ideas using speech and gesture: Evidence from statistics lessons. Thematic Panel presented at the Sixth conference of the International Society for Gesture Studies (ISGS), San Diego, CA.

6. *Donovan, A., +Boncoddo, R., *Williams, C. C., Walkington, C., *Pier, E. L., *Waala, J., **Nathan, M. J.**, & Alibali, M. W. (2014, July). Action, gesture and abstraction in mathematical learning. Thematic Panel presented at the Sixth conference of the International Society for Gesture Studies (ISGS), San Diego, CA.

7. **Nathan, M. J.** & +Boncoddo, R. (2014, July). Teachers' attitudes and beliefs about the utility of gestures in classroom learning and instruction. In Teachers' Gestures in Instruction: Attitudes, Behavior, and Research Approaches. Thematic Panel presented at the Sixth conference of the International Society for Gesture Studies (ISGS), San Diego, CA.

8. **Nathan, M. J.** (2013, April). Session Chair: *Reasoning and Learning in Engineering and Computer Science Education.* Paper presentation to the Annual Meeting of the American Educational Research Association (San Francisco, CA).

9. **Nathan, M. J.** (2011, April). Using cognitive science to understand why, for whom, under what conditions interventions succeed or fail. Chair and presentation to the American Educational Research Association annual meeting (New Orleans).

10. **Nathan, M. J.**, & Vandell, D. (2011, April). So you want to be a peer reviewer: Learning to review annual meeting papers and enhancing annual meeting quality. Workshop for the American Educational Research Association annual meeting (New Orleans).

11. *Kim, S. & **Nathan, M. J.** (2010, August). Gestures reveal thinking-for-speaking patterns in high and intermediate proficiency English language learners. Twentieth Anniversary Meeting of the Society for Text & Discourse (Chicago).

12. **Nathan, M. J.** (2010, August). How professional development changes high school STEM teachers' beliefs. P-12 Engineering and Design Education Research Summit, 2010 (Seaside, OR). Institute for P-12 Engineering Research and Learning, Purdue, University.

13. **Nathan, M. J.** & *Johnson, C. V. (2010, August). The relation of situation models to gesture production when learning from a scientific text. Twentieth Anniversary Meeting of the Society for Text & Discourse (Chicago).

14. &* Johnson, C. V. (2010, June). Drawing inferences: How gestures and speech convey students' mental models of dynamic processes depicted in scientific drawings. In Ainsworth,

S., & **Nathan, M. J.** (chairs) Learning about dynamic systems by drawing. International Conference of the Learning Sciences 2010 (Chicago).

15. **Nathan, M. J.**, Rummel, N., & Hay, K. E. (2010, June). Growing the Learning Sciences: Brand or Big Tent? Implications for Graduate Education. International Conference of the Learning Sciences 2010 (Chicago).

16. **Nathan, M. J.** (2010, June). Discussant for "Social construction of mathematical meaning through collaboration and argumentation" (Baruch Schwarz, Organizer & Chair). International Conference of the Learning Sciences 2010 (Chicago).

17. Alibali, M. W., Church, R. B., **Nathan, M. J.**, Knuth, E. J., Wolfgram, M. S., *Jacobs, S. A., *Hostetter, A., & *Johnson, C. V. (2009, April). How teachers link mathematical ideas in instructional communication. In the Symposium "Can Findings From Developmental Science Transform Instruction and Improve Education Outcomes?" (Chair: Elizabeth R. Albro) 2009 Society for Research in Child Development (SRCD) Biennial Meeting, Denver, CO.

18. *Hattikudur, S., Asquith, P. S., *Kim, S., Knuth, E. J., **Nathan, M. J.**, & Alibali, M. W. (2009, April). Representational fluency in middle school: A look at curriculum and student performance. Poster presentation for 2009 Society for Research in Child Development (SRCD) Biennial Meeting, Denver, CO.

19. *Jacobs, S., Church, R. B., Johnson, C., *Kim, S., Wolfgram, M. S., Alibali, M. W. & **Nathan, M. J.** (2009, October). *How teachers link mathematical ideas in classroom instruction*. Poster presented at the biennial meeting of the Cognitive Development Society, San Antonio, Texas.

20. *Jacobs, S. A., Church, R. B., **Nathan, M. J.**, Knuth, E. J., Wolfgram, M. S., & Alibali, M. W. (2009, April). How teachers use representational gestures in the classroom to teach algebraic concepts. Poster presentation for 2009 Society for Research in Child Development (SRCD) Biennial Meeting, Denver, CO.

21. **Nathan, M. J.** (2009, October). Discussant for "Understanding Knowledge Change: Investigations on How Children Learn Mathematics and Literacy Skills." Cognitive Development Society 2009 annual meeting (San Antonio, TX).

22. **Nathan, M. J.** (2009, April). Chair for the symposium "The role of concrete examples in learning math: Resolving some paradoxes" (with presenters Ken Koedinger, Martha Alibali, Jennifer Kaminski & Vladimir Sloutsky). 2009 Society for Research in Child Development (SRCD) Biennial Meeting, Denver, CO.

23. **Nathan, M. J.** (2009, April). Discussant for the symposium "Cognitive Underpinnings of Complex Mathematics Skills: Longitudinal Investigations." (Chair: Kerry Lee) 2009 Society for Research in Child Development (SRCD) Biennial Meeting, Denver, CO.

24. (2009, April). Chair for the Working Group "Cognitive Science and Education." American Educational Research Association annual meeting, San Diego, CA.

25. **Nathan, M. J.** & Alibali, M. W. (2009, May). Grounding and action in an embodied approach to mathematical teaching, learning and communicating. Presentation to the Embodied Mathematics Advisory Board, Madison, WI.

26. **Nathan, M. J.** & *Johnson, C. V. (2009, April). Gestures and mental models. Poster presented to the American Educational Research Association annual meeting, San Diego, CA.

27. **Nathan, M. J.** (2008, June). The role of visual scaffolding in students' mathematics learning: Evidence from early algebra. Poster presentation to the Third Annual Research Conference of the US Department of Education-Institute of Educational Sciences, Washington, DC.

28. **Nathan, M. J.** (2008, March). Discussant for "Math education meets gesture studies: How mathematics education adapts gesture studies to its own purposes," presented to the American Educational Research Association annual meeting. New York.

29. **Nathan, M. J.** (2008, March). Discussant for "Mapping 'Geography of Opportunity' in a large-scale randomized experiment on enhancing mathematics with technology," presented to the American Educational Research Association annual meeting. New York.

30. **Nathan, M. J.** (2008, March). Chair for "Embodiment for Education," (Arthur Glenberg, Presenter) presented to the American Educational Research Association annual meeting. New York.

31. **Nathan, M. J.** (2008, March). Chair for "Tangible media and mathematical imagination," (Ricardo Nemirovsky, Presenter) presented to the American Educational Research Association annual meeting. New York.

32. Alibali, M. W., & **Nathan, M. J.** (2007, June). A symposium entitled "Mechanisms by which Gestures Contribute to Establishing Common Ground: Evidence from Teaching and Learning" presented to the International Society for Gesture Studies (ISGS) Third International Conference. Evanston, IL.

33. *Bieda, K. & **Nathan, M. J.** (2007, June). Going beyond: What gesture shows us about students' notions of graphs. Poster presentation to the International Society for Gesture Studies (ISGS) Third International Conference. Evanston, IL.

34. *Hattikudur, S., *Prather, R. W., Asquith, P., Knuth, E., **Nathan, M. J.**, & Alibali, M. W. (2007, April). Graphing slope and intercept in middle school. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Boston, Massachusetts.

35. **Nathan, M. J.** (2007, April). Discussant for Symposium entitled "Using qualitative research methods to understand engaged learning in online communities" presented to the American Educational Research Association annual meeting. Chicago, IL.

36. **Nathan, M. J.** (2007, April). Chair of "The nature and role of tasks that foster learning in mathematics teacher education." Symposium presented to the American Educational Research Association annual meeting. Chicago, IL.

37. **Nathan, M. J.** & Alibali, M. W. (2007, June). Giving a hand to the mind: Gesture enables intersubjectivity in classroom. In a symposium entitled "Mechanisms by which Gestures Contribute to Establishing Common Ground: Evidence from Teaching and Learning" presented to the International Society for Gesture Studies (ISGS) Third International Conference. Evanston, IL.

38. Woods, D., **Nathan, M. J.**, & *Bieda, K. & (2007, June). "Data session on Transana use for qualitative and quantitative gesture analysis" presented to the International Society for Gesture Studies (ISGS) Third International Conference. Evanston, IL.

39. *Jackson, K. & **Nathan, M. J.** (2006, May). Boolean logic and qualitative research. Paper presented to the Session on "The Ethics of Embodiment" at The Second International Congress of Qualitative Inquiry. University of Illinois, Urbana-Champaign, IL.

40. **Nathan, M. J.** (2006, June). Discussion of "Epistemic games and scaffolding." Presentation to the International Conference of the Learning Sciences. University of Indiana, Bloomington, IN.

41. **Nathan, M. J.** & Knuth, E. (2006, April). Jim Kaput's legacy and impact on mathematics education, learning technology and educational reform. Chair and Organizer of Symposium for the American Educational Research Association annual meeting. San Francisco, CA.

42. **Nathan, M. J.** (2005, April). Discussant for "Advanced Technologies for Learning," Presentation to the American Educational Research Association annual meeting. Montreal, Canada.

43. **Nathan, M. J.** (2005, April). Discussant for "Attending to student thinking in mathematics teaching," Presentation to the American Educational Research Association annual meeting. Montreal.

44. **Nathan, M. J.** & *Bieda, K. (2005, May). Revealing students' understanding of graphs through gesture and metaphor. Paper presented to the STAAR (Supporting the Transition from Arithmetic to Algebraic Reasoning) annual meeting. Estes Park, CO.

45. **Nathan, M. J.** & *Jackson, K. (2005, April). The impact of Boolean operators on tool use: an embodied cognition perspective. Presentation to The Second Conference on Teaching Qualitative Methods University of Wisconsin, Madison, WI.

46. **Nathan, M. J.** & *Kim, Sunae. (2005, May). Representational fluency. Paper presented to the STAAR (Supporting the Transition from Arithmetic to Algebraic Reasoning) annual meeting. Estes Park, CO.

47. **Nathan, M. J.** & *Kim, Suyeon. (2005, May). How teacher mitigated feedback fosters classroom learning. Paper presented to the STAAR (Supporting the Transition from Arithmetic to Algebraic Reasoning) annual meeting. Estes Park, CO.

48. **Nathan, M. J.** (2004, April). Chair and Organizer of Symposium: Supporting middle school teachers to assist students make the transition from arithmetic to algebraic reasoning. American Educational Research Association annual meeting. San Diego, CA.

49. **Nathan, M. J.** (2002, April). Discussion of "The many facets of algebra." Presentation to the American Educational Research Association annual meeting. New Orleans, LA.

50. **Nathan, M. J.** (2002, April). Discussion of "Collaborative technologies: A European perspective." Presentation to the American Educational Research Association annual meeting. New Orleans, LA.

51. **Nathan, M. J.** (2000, April). Session Chair and Organizer: : Teachers crafting their own professional development for technology in the content areas. Presentation to the American Educational Research Association annual meeting. New Orleans, LA.

52. **Nathan, M. J.** (1999, April). The teaching and learning of early algebra at the middle school level: A 3-year review. Chair of Symposium for the American Educational Research Association annual meeting. Montreal, Canada.

53. **Nathan, M. J.** (1995, April). A discussion on "The Multimedia Journal Article" format as a new technology for reporting research and evaluation projects (panel chair, organizer, and presenter). American Educational Research Association (AERA) annual meeting. (with J. Hawkins, B. J. Hood, R. Hall, L. Erlbaum, & E. Soloway).

54. **Nathan, M. J.** (1994, January). How many situation models? Presentation to the Winter Text Conference. Jackson Hole, WY.

55. **Nathan, M. J.** (1993, January) Assessing and improving comprehension of mathematical story problems. Presentation to the Winter Text Conference. Jackson Hole, WY.

56. **Nathan, M. J.** (1993. August). A comparative analysis of learning environment design: The case of mathematical word problem solving (panel chair and presenter). Presentation to AI & Education annual meeting (Edinburgh, UK).

57. **Nathan, M. J.** (1993, August). European Association For Research on Learning and Instruction (EARLI). "Inference-making during word problem solving." (Aix-en-Provence, France).

58. **Nathan, M. J.** & Resnick, L. B. (1992, July). Less can be more. Presentation to the NATO Advanced Study Institute (ASI) on the Psychological and Educational Foundations of Technology-Based Learning Environments (Crete, Greece).

59. **Nathan, M. J.** (1988, April). Animating algebra word problems. Presentation to the Rocky Mountain Psychological Association Conference. Snowbird, UT.

60. Greenberg, H. J. & **Nathan, M. J.** (1986, October). Object decomposition for collision avoidance. Presentation to the ORSA/TIMS Joint National Meeting. Miami, FL.

Technical Reports & White Papers

1. **Nathan, M.J.**, Williams-Pierce, C., Walkington, C., Abrahamson, D., Ottmar, E., Soto, H., & Alibali, M.W. (2021). *Embodied Design for Mathematical Imagination and Cognition*. In Rapid Community Report Series. https://repository.isls.org//handle/1/6852

2. **Nathan, M. J.**, Williams-Pierce, C., Walkington, C., Abrahamson, D., Ottmar, E., Soto, H., & Alibali, M. W. (2019). *The Future of Embodied Design for Mathematical Imagination and Cognition.* Available at circlcenter.org/events/synthesis-design-workshops/

3. **Nathan, M. J.**, Rittle-Johnson, B., & Fyfe, E. (2016). Translational Research at the Intersection of Cognitive Science and Education. For the James S. McDonnell Foundation.

   NB. This provided the intellectual basis *for the JSMF research grant program "Teachers as Learners."*

4. Pier, E. L., Raclaw, J., Ford, C. E., & **Nathan, M. J.** (2015). Studying the study section: How group decision making in person and via videoconferencing affects the grant peer review process. WCER Working Paper Series, no. 2015-06. Wisconsin Center for Education Research: Madison, WI. Available at http://www.wcer.wisc.edu/publications/workingpapers/Working_Paper_No_2015_ 06.pdf

5. **Nathan, M. J.**, Alibali, M. W., *Masarik, D. K., *Stephens, A. C., & Koedinger, K. R. (2010). Enhancing middle school students' representational fluency: A classroom based study. WCER Working Paper Series no, 2010-9. Wisconsin Center for Education Research: Madison, WI. Available at www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2010_09.pdf

6. *Tran, N. A., *Nathan, A. B., & **Nathan, M. J.** (2010). Hand Matching vs. Propensity Score Matching: An Empirical Comparison of Results From a Quasi-Experiment. WCER Working Paper Series no, 2010-7. Wisconsin Center for Education Research: Madison, WI. Available at http://www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2010_07 .pdf

7. Alibali, M. W., *Brown, A. N., *Stephens, A. C., *Kao, Y. S., & **Nathan, M. J.** (2009). Middle School Students' Conceptual Understanding of Equations: Evidence From Writing Story Problems. WCER Working Paper No. 2009-3. Wisconsin Center for Education Research: Madison, WI. Available at www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2009_03.pdf

8. **Nathan, M. J.**, *Kim, S., & *Grant, T. (2009). Instituting change in classroom discourse structure: Human and computer-based motif analyses. WCER Working Paper Series WCER Working Paper Series no, 2009-1. Wisconsin Center for Education Research: Madison, WI. Available at http://www.wcer.wisc.edu/publications/workingPapers/Working_Paper_No_2009_01 .pdf

9. *Grant, T. & **Nathan, M. J.**. (2008). Students' conceptual metaphors influence their statistical reasoning. WCER Working Paper Series no. 2008-5. Wisconsin Center for Education Research: Madison, WI. At http://www.wcer.wisc.edu/Publications/workingPapers/papers.php

10. **Nathan, M. J.**. & *Kim, S. (2007). Regulation of teacher elicitations and the impact on student participation and cognition. WCER Working Paper Series no. 2007-04. Wisconsin Center for Education Research: Madison, WI. Available at www.wcer.wisc.edu/publications/workingPapers/Working_Paper_No_2007_04.php.

11. **Nathan, M. J.**, *Kim, S. & Eilam, B. (2006). To disagree, we must also agree: How intersubjectivity structures and perpetuates discourse in a mathematics classroom. WCER

Working Paper Series no. 2006-3. Wisconsin Center for Education Research: Madison, WI. At http://www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2006_6. pdf

12. **Nathan, M. J.** & *Jackson, K. (2006). Boolean classes and qualitative inquiry. WCER Working Paper Series no. 2006-3. Wisconsin Center for Education Research: Madison, WI. Available at http://www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2006_3. pdf

13. **Nathan, M. J.** & *Bieda, K. N. (2006). Middle school students' use of speech and gesture in pattern generalization tasks involving graphs: Evidence that bounded views influence performance. WCER Working Paper Series no. 2006-2. Wisconsin Center for Education Research: Madison, WI. Available at www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2006_2.pdf

14. **Nathan, M. J.** (2005). Rethinking formalisms in formal education. WCER Working Paper Series no. 2005-11. Wisconsin Center for Education Research: Madison, WI. Available at http://www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2005_11 .pdf

15. **Nathan, M. J.** & Eilam, B. (2005). Visual display and co-expressivity as students strive for intersubjectivity in a spatial reasoning task. WCER Working Paper Series no. 200510. Wisconsin Center for Education Research: Madison, WI. Available at http://www.wcer.wisc.edu/Publications/workingPapers/Working_Paper_No_2005_10 .pdf

16. **Nathan, M. J.** (2003). Confronting teachers' beliefs about algebra development: Investigating an approach for professional development. Institute of Cognitive Science Technical Report no. 03-04. Boulder, CO: The University of Colorado.

17. **Nathan, M. J.** & Petrosino, A. J. (2003). Expert blind spot among preservice mathematics educators. Institute of Cognitive Science Technical Report no. 03-02. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/03-02.pdf

18. **Nathan, M. J.**, *Masarik, D. K., *Stephens, A. C., Alibali, M. W., & Koedinger, K. R. (2001). Enhancing middle school students' representational fluency: A classroom based study. Technical Report no. 01-05. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/01-05.pdf

19. **Nathan, M. J.**. & Kalmon, S. (2001). Teachers crafting their own professional development for educational technology: The WorkingShops Model. Institute of Cognitive Science Technical Report no. 01-04. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/01-04.pdf

20. **Nathan, M. J.** (2001). Implicit views of mathematical development within algebra textbooks: Implications for educational reform. Institute of Cognitive Science Technical Report no. 01-03. Boulder, CO: The University of Colorado. Available http://ics.colorado.edu/techpubs/pdf/01-03.pdf

21. **Nathan, M. J.**, *Long, S. D., & Alibali, M. W. (2000). The symbol precedence view of mathematical development: An analysis of the rhetorical structure of algebra textbooks. Institute of Cognitive Science Technical Report no. 00-07. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/00-07.pdf

22. **Nathan, M. J.**. & Robinson, C. (2000). Considerations of Learning & Learning Research: Revisiting the "Media Effects" Debate. Institute of Cognitive Science Technical Report no. 00-06. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/00-06a.pdf

23. **Nathan, M. J.**, Koedinger, K. R., and Alibali, M. W. (2000). Expert blind spot: When content knowledge and pedagogical content knowledge collide. Institute of Cognitive Science Technical Report no. 00-05. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/00-05.pdf

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25. **Nathan, M. J.** & Koedinger, K. R. (1999). Teachers' and researchers' beliefs about algebra development. Institute of Cognitive Science Technical Report no. 99-04. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/99-04.pdf

26. **Nathan, M. J.**, and Koedinger, K. R. (1999). Teachers' judgments about algebra problem difficulty. Institute of Cognitive Science Technical Report 99-03. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/99-03.pdf

27. **Nathan, M. J.,** Koedinger, K., and Tabachneck, H. T. (1996). Difficulty factors in arithmetic and algebra: The disparity of teachers' beliefs and students' performances. Institute of Cognitive Science Technical Report 96-06. Boulder, CO: The University of Colorado.

28. Koedinger, K., **Nathan, M. J.** & Tabachneck, H. T. (1995). Understanding Informal Algebra and Bridging to Symbolic Algebra: First year report to the James S. McDonnell Foundation program for Cognitive Studies in Educational Practice. (Grant no. JSMF 95-11). Pittsburgh, PA: Author.

29. Lewis, A. B. & **Nathan, M. J.** (1991). A framework for improving students' comprehension of word arithmetic and word algebra problems. Institute of Cognitive Science Technical Report no. 91-05. Boulder, CO: The University of Colorado. Available at ics.colorado.edu/techpubs/pdf/91-05.pdf

30. Lewis, A. B., **Nathan, M. J.,** & Birnbaum, L. (1991). A framework for improving students' comprehension of word arithmetic and word algebra problems. In *Proceedings of the International Conference on the Learning Sciences* (pp. 305-314). Association for the Advancement of Computing in Education Charlottesville, VA.

31. **Nathan, M. J.** Sparks, R., & Wolff, A. S. (1991). Anatomy and autopsy of an intelligent tutor: The WITS system from Bellcore. U S West Science and Technology Research Report.

32. **Nathan, M. J.**, Kintsch, W., & Young, E. (1990). A theory of algebra word problem comprehension and its implications for unintelligent tutoring systems. Institute of Cognitive Science Technical Report no. 90-02. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/90-02.pdf

33. **Nathan, M. J.**, Kintsch, W., & Lewis, C. (1988). Tutoring Algebra Word Problems. Institute of Cognitive Science Technical Report no. 88-12. Boulder, CO: The University of Colorado. Available at http://ics.colorado.edu/techpubs/pdf/88-12.pdf

Other Scholarly Contributions

Nathan, M. J. (2008). *Handbook for AERA Division C Program Chairs.* Madison, WI: Author.

Work referenced in U. S. Patent #5808912 "Method for dimensional weighing utilizing point determination." U. S. Patent Issued on September 15, 1998 to Daniel F. Dlugos and Earl B. Holtz (Pitney Bowes Inc.)

Curriculum and Learning Environment Development

TECHNOLOGIES FOR EMBODIED CONCEPTUAL REASONING (2016-Date) – The wide accessibility of sensors and algorithms for processing real-time body movement has led to the design of a new class of educational technology that can elicit directed actions among individuals and small groups in ways that advance their conceptual understanding of advanced concepts such as geometric proof. An example is *The Hidden Village*. Multiplex.videohall.com/presentations/1662

GROUNDED AND EMBODIED LEARNING (2014-Date) – Meaningful learning include nonverbal, body-based ways of knowing and processes that can operate outside of conscious awareness. This has implications for the design of learning, teaching, and assessment.

STEM CAREER DEVELOPMENT (2012-Date) – How do people find jobs in the digital age, and what role does their educational experience play, especially in STEM fields? The line of inquiry investigates the growing use of online resources for early career development ("What do I want to be when I grow up), adult job attainment, software analytics, and curriculum and simulation design to understand and improve the how people find suitable employment.

GROWING THE LEARNING SCIENCES (2010-Date) – I examine the common and varied approaches to Learning Sciences graduate education from existing programs worldwide and explore the tensions within interdisciplinary education and trade-offs between adherence to a common core (maintaining a "brand") or a broadly inclusive model (forming a "big tent").

GESTURE USE IN STEM INSTRUCTION (2006-Date) – This program explores methods by which teachers and animated pedagogical agents can use gestures to enhance the instruction and learning of abstract ideas in mathematics and engineering contexts.

PREPARATION FOR A CAREER IN EDUCATIONAL RESEARCH (2005-Date) – Graduate students need mentoring to explore and develop the knowledge and skills needed for emerging doctoral students to establish productive careers in educational research, spanning educational psychology, educational policy, educational leadership, social foundations, and curriculum and instruction.

NOVEL OUTPUT DEVICES FOR SMET (2002-2004) – Student activities and teacher professional development program to promote the design and construction of physical artifacts for science, mathematics, engineering and technology (SMET) education for undergraduates, high school, and middle school students that utilize novel output devices such as laser cutters.

REPRESENTATIONAL FLUENCY (2000-2002) – A nine-week unit that includes classroom activities, teaching methods ("Bridging Instruction for Seventh and Eighth Grade Algebra") and assessment instruments for cultivating flexible uses of formal algebra-level representations. Taught two consecutive years.

WORKINGSHOPS (1995-99) – An integrated, in-school staff development program that brings teams of high school teachers, school of education faculty, and cognitive science researchers (in psychology and computer science) to promote self-directed professional development in areas of educational technology, state standards, and curriculum reform.

EARLY ALGEBRA CURRICULUM (1995-2000) – A twelve-week unit that includes classroom activities, teaching methods ("Bridging Instruction for Sixth Grade Algebra") and assessment instruments for cultivating algebraic reasoning and uses of symbolic representations at the sixth grade level.

SMART TOOLS (1994-95) – Computer tools to support use of formal representations and simulations in complex, quantitative problem solving.

THE ADVENTURES OF JASPER WOODBURY (1993-95) – Video-based narrative tools for complex, collaborative mathematical problem solving in geometry and algebra.

ANIMATE (1988-1996) – An unintelligent tutoring system for integrating quantitative and verbal (text-based) reasoning in service of solving algebra level story problems.

Teaching

UNIVERSITY OF WISCONSIN

Inductee, Teaching Academy, University of Wisconsin, April, 2014.

ED PSY 509: Embodied Cognition & Education. This interdisciplinary course is organized as a graduate-level or advanced undergraduate-level seminar. Students will examine the nature of thinking, teaching and learning from an embodied perspective, looking at how intellectual behavior is influenced by body-based resources, such as gestures, spatial systems, emotions, metaphors, and the architecture of our sensory and motor systems.

ED PSY 533: Thinking, Feeling and Learning. Seminar for clinical psychology doctoral students in school psychology, counseling psychology and rehabilitation psychology required for APA

licensure requirements in cognition, affect and neuroscience. (Previously Ed Psych 795-002) Fall 2014-2021.

ED PSY 795 & ED PSY 796: Introduction to Learning Sciences I & II (two-semester sequence). Academic years 2008-09, 2009-10, 2010-2011, 2012-2013.

EPD 654 / InterL&S701 / InterCALS 875 / Ed Psych 711 The College Classroom Course (Part of the University of WI CIRTL Certificate Program). Fall 2006, 2008, 2013. Theory and practice of undergraduate education.

ED C&I 916 / ED PSY 711: Doctoral Research Program Pro-seminar (two-semester sequence). 2005-07.

ED PSY 711 Epistemologies of Mathematics and Science. Symposium on advanced topics, including: Embodied cognition. Fall 2004, Spring 2006.

ED PSY 711 Embodied Cognition. Symposium on advanced topics, including: Embodied cognition. Spring 2008, Fall 2011, Spring 2012.

UNIVERSITY OF COLORADO

EDUC 4112 Educational Psychology and Adolescent Development (BA/Post-BA Secondary teacher education section)

EDUC 5705 Theories of Learning and Development (MA elementary teacher education section)

EDUC 6318 Psychological Foundations of Education (MA/PhD section; *cross-listed for Cognitive Science certification*)

EDUC 6318 Psychological Foundations of Education (MA Secondary teacher education section)

EDUC 6338 Cognitive Processes in Education: Central conceptual structures *(Cross-listed for Cognitive Science certification*)

EDUC 6338 Cognitive Processes in Education: Mathematical cognition *(Cross-listed for Cognitive Science certification*)

EDUC 6505 Readings and Research in Cognitive Science *(Cross-listed as Computer Science 7762/EDUC 6505/LING 7762/PHIL 7310/PSYCH 7762*)

EDUC 8358 Doctoral Seminar: Human Learning. A critical look at learning and technology *(Cross-listed for Cognitive Science certification*)

EDUC 8358 Doctoral Seminar: Human Learning. Theoretical and methodological issues in classroom-based research for mathematics and science learning *(Cross-listed for Cognitive Science certification*) **VANDERBILT UNIVERSITY**

Cognitive Processes in Education, Fall, 1994 (Co-taught with Prof. John Bransford).

National and International Professional Service Activities

National Schools of Education Mentorship Circle

Faculty-Mentor to 4 tenure-track assistant professors within the Schools of Education Mentorship Circle, organized by the deans of ten leading schools of education (Berkeley, Columbia Teachers College, Harvard, Michigan, Michigan State, Northwestern, Penn, Stanford, UCLA, Wisconsin).

National Academies

National Academies of Science/National Research Council. Consensus committee member, "Engaging Middle and High School Students in Science and Engineering: New Approaches to Investigation and Design," 2017-2018.

National Academy of Sciences (NAS) Space Studies Board and National Research Council (NRC) Board on Science Education - Planning committee for *Sharing the Adventure with the Student: Exploring the Intersections of NASA Space Science and Education* (20142015).

National Academy of Engineering and the National Research Council (NAE/NRC) Committee on Integrated STEM Education (2011-2014).

Offices Held in Professional Societies

International Society of the Learning Sciences (ISLS) Committee Chair, Early Career Award (inaugural), 2019 to 2021.

International Society of the Learning Sciences (ISLS) Editorial Board member, *The Journal of the Learning Sciences.* June 2015 to date

American Society for Engineering Education (ASEE), Advisory Board to the Editor, *Journal of Engineering Education*. 2015 to date

International Society of the Learning Sciences (ISLS) Conferences Committee member. June 2013 to 2019

Graduate student mentor - AERA Division C Graduate Student Seminar. Dr. Kelly Rodgers, Chair. 2015

Graduate student mentor - AERA Division C Graduate Student Seminar. Dr. Jennifer Cromley, Chair 2012

American Educational Research Association (AERA). Annual Meeting Policies and Procedures (AMPP) Committee. Chair-designate 2008, and Chair 2009-2011

International Society of the Learning Sciences (ISLS) Founding officer - Secretary/Treasurer. 2002-2005

Editorial Duties

The Journal of the Learning Sciences. Associate Editor/Editorial Board member June 2015 to date.

American Educational Research Journal: Teaching, Learning, and Human Development section. Editorial Board member Oct. 2011 to 2015

Journal for Research in Mathematics Education (JRME), Editorial Panel Member (NCTM), 2011-2014

Journal of Pre-College Engineering Education Research (JPEER). Editorial Board member (inaugural). 2010-date

Review of Educational Research. Editorial board member. American Educational Research Association (AERA). 2009-2015

Journal of Educational Psychology. Advisory Editor. American Psychological Association (APA). 2008-2015

Guest editor for a special issue on children's development of algebraic reasoning for *Mathematical Thinking and Learning*, 2007

Cognition and Instruction. Editorial board member. Lawrence Erlbaum Associates. 2006 to date

The International Journal of Applied Intelligence. Editorial board member, Kluwer Academic. Past member

National Institutes of Health (NIH), "AIDS and related research" (SBIRs). Standing Editorial Board member (Dr. Gilbert W. Meier, Chair). Past member

Conference Program Committee Member

Member of the Organizing Committee for The 2nd ICCE workshop on Embodied Learning: Technology Design, Analytics & Practices (EMBODIED@ICCE2022), at the 30th International Conference of Computers in Education (ICCE) November 28-December 02, 2022, Kuala Lumpur, Malaysia (Virtual).

International Society of the Learning Sciences (ISLS) 2022 Second Annual Conference, Hiroshima, Japan (Virtual).

Computer-Supported Collaborative Learning (CSCL) 2018 in London, England.

American Educational Research Association (AERA) 2014 (San Francisco), Section Chair for Learning and Instruction—Engineering Education and Computer Science Education (Division C, Section 1e.

American Educational Research Association (AERA) 2013 (San Francisco), Section Chair for Learning and Instruction—Engineering Education and Computer Science Education (Division C, Section 1e. Note 2013 was the fledgling year for this section).

Cognitive Science Society Annual Meeting 2011 (Boston, MA). Publicity Committee chair and Member of the Program Committee.

American Educational Research Association (AERA) 2009 (San Diego), 2010 (Denver), 2011 (New Orleans). Ex-Officio Member of the Program Committee.

Society for Text and Discourse 2010 (Chicago). Member of the Program Committee.

Cognitive Science Society Annual Meeting 2010 (Portland, OR). Publicity Committee chair and Member of the Program Committee.

American Educational Research Association (AERA) 2009 (San Diego). Ex-Officio Member of the Program Committee.

Cognitive Science Society Annual Meeting 2009 (Amsterdam). Publicity Committee chair and Member of the Program Committee.

American Educational Research Association (AERA) 2008 (New York City). Program Chair (Division C).

Cognitive Science Society Annual Meeting 2008 (Washington, DC). Publicity Committee chair and Member of the Program Committee.

Cognitive Science Society Annual Meeting 2007 (Nashville, TN). Publicity Committee cochair and Member of the Program Committee.

American Educational Research Association (AERA) 2006 (San Francisco). Section Chair for Learning and Instruction—Mathematics (Division C, Section 3).

International Conference on the Learning Sciences (ICLS), 2004 (Santa Monica, CA). Member of Program Committee

Computer-Supported Collaborative Learning 2002 (Boulder, CO). Member of Program Committee

International Conference on Cognitive Science 2001 (Beijing). Member of Program Committee and Symposium Chair "Cognitive Science in Education."

Session Chair and Program Committee member for The Society of Photo-Optical and Instrumentation Engineers' Cambridge Symposium on "Recent Advances in Intelligent Robotic Systems," 1986-1988, Cambridge, MA.

Advisory Board Member/Committee Member

Advisor on the Advisory Committee of the Centre for University & School Partnership (CUSP), Faculty of Education, The Chinese University of Hong Kong (CUHK). 2021 to 2024.

Chair, James S. McDonnell Foundation (JSMF) *Teachers as Learners* (TaL) program (2017 to date).

Advisory Board Member, Stanford University College of Engineering, PATHS – Pathways from School to Work. Advising on data collection, analysis and interpretation of data from a longitudinal study of undergraduate engineering students from college into the workforce, with policy recommendations for national engineering education and advising. 2017 to 2021.

Advisory Board Member for INSPIRE (Purdue's Institute for P-12 Engineering Research and Learning), Purdue University (Summer 2012 to date).

External Evaluator for Carnegie Mellon "Learning with Multiple Graphical Representations in a Complex, Real-world domain: Intelligent Software Tutors for Fractions" project (NSF-REESE). (2009 to 2015).

Advisory Board Member for University of Maryland "Connected Chemistry" project (NSF funded).

"CoMPASS: Integrating Digital Text in Design-based Science Classrooms," studies ways to provide a close coupling of hands-on activities and reading from informational text so that students access, evaluate, and interpret scientific information, and apply it to their ongoing exploration of physical phenomena. Funded by IERI (NSF, Dept of Ed-IES and NIH-NICHHD, 2004-2009).

"Algebra for All Project" addressing teacher professional development that focuses on research-based pedagogical practices, the accommodations and modifications necessary to support the success of all students, and increased mathematical content knowledge through curricular previews for both special educators and regular educators. Submitted by University of Colorado-Denver and National Institute for Urban School Improvement for funding consideration to Office of Special Education and Rehabilitative Services, U S Department of Education.

"Project IMPACTS," directed by James Slotta, Marcia Linn, Doug Clark. A collaboration with Denver Public Schools, University of California-Berkeley, and Arizona State University to study scaling to district-wide participation in inquiry based middle school science education for diverse students, especially second language learners. Submitted for funding consideration to IERI (NSF, OERI, NICHD).

National Advisory and Review Panel for the "Online Mathematics Initiative," The University of Texas at Austin. (July, 2002 to 2005)

National Design Experiments Consortium, Jan Hawkins, Chair. 1993-1996.

Standing Review Boards & Ad Hoc Reviewer

American Educational Research Association (AERA) Annual Meeting. Standing review board member, Division C – Section 3 (Mathematics Education) 2010, 2011, 2012.

American Educational Research Association (AERA) Annual Meeting. Standing review board member, Division C – Section 6 (Cognitive, Social and Motivational Processes) 2010, 2011, 2012.

U S Department of Education-IES Basic Processes Review Panel. Principal Reviewer. 2010 to 2020.

American Educational Research Journal. American Educational Research Association (AERA)

Cognition and Instruction. Lawrence Erlbaum Associates

Cognitive Science, Ablex Publishing

Cognitive Science Society Annual Meeting

Elsevier • North-Holland, Dept of Mathematics, Computer Science & Cognitive Science

Educational Assessment

Educational Psychology Review

Educational Researcher, American Educational Research Association (AERA)

Institute for Education Sciences (IES), U.S. Department of Education

Interagency Educational Research Initiative (National Science Foundation, U.S. Dept. of Education-IES, and National Institutes of Health-NICHHD)

Journal for Research in Mathematics Education. National Council for Teachers of Mathematics (NCTM).

Learning and Individual Differences, Elsevier

James S. McDonnell Foundation, Cognitive Studies for Educational Practice grants

Mathematical Thinking and Learning (Taylor & Francis)

Memory & Cognition, Psychonomic Society

National Science Foundation (NSF): ROLE, CAREER, IERI

Review of Educational Research, American Educational Research Association (AERA)

Other University and Community Service

Faculty Governance

Social Studies Divisional Committee Member (elected), University of Wisconsin, 2014; 2015-2018

Member, Committee on Honorary Degrees (appointed), University of Wisconsin, 2015-2016

Executive Committee Member, Teaching Academy, University of Wisconsin, June, 2014-2015.

Chair, Learning Sciences Graduate Program, Educational Psychology Dept., School of Education (Oct., 2005 to 2010).

Advisory Board Member, Doctoral Research Program, School of Education (2005-07). Program focuses on the professional development (vision, method, theory, experience) of aspiring educational researchers in the Education graduate program.

Representative to the Faculty Senate for the Educational Psychology Dept. (2005-2009).

Presentation to the Teaching Improvement Program in the College of Engineering (UW Teaching Academy), "How students learn: Thinking, teaching and design." With Dr. Erica Halverson (Aug. 25, 2005).

Coordinating Council for Teacher Education (CCTE) for the School of Education.
Representative for Educational Psych. Dept. (2004-07)

Harassment Contact for the Educational Psychology Dept. (2004-2010)

STEM (Science, Technology, Engineering, and Mathematics) Education

University of Wisconsin-Madison Provost's Office for STEM Outreach Task Force (June 2012 to date). Tasked with examining the feasibility of a campus-wide Office for STEM Outreach (Kevin Niemi, Chair).

Steering Committee Member, University of WI, Delta Learning Community (2005 to date). Delta is a research, teaching and learning community for faculty, academic staff, post-docs, and graduate students that helps current and future faculty implement teaching-as-research and teaching for diverse audiences in science, engineering, and mathematics higher education. Delta operates within the CIRLT Network.

Equity and Conflict Resolution

Uni-Hill Peacemaker Project (Boulder, CO). Training Boulder residents and CU students in non-violence and conflict resolution skills.

Member of the Chancellor's Task Force on Civil Conduct on Boulder Campus

Victim Offender Reconciliation Project (VORP), Nashville, TN

Technology

Member of the American Educational Research Association (AERA) Technology Committee (formerly the Telecommunications Committee). Term 2003-06.

Member of the U. of Colorado-Boulder Faculty Assembly Committee on Technology.

Boulder (CO) Valley School District: Develop and test "KidSearch", an Internet resource for elementary school teachers and students (including non-readers)

Member of University of Colorado ATLAS Initiative for campus technology, subcommittee on Research in Educational Technology

Developed the University of Colorado-Boulder School of Education state-of-the-art classroom for teaching about and with technology (from in-house grants)

Co-Director of the WorkingShops Project for teacher professional development on technology in teaching, New Vista High School, Boulder (CO) Valley School District.

Member of the New College of Information Technology Exploratory Committee, University of Colorado.

University of Colorado, Presidents' Total Learning Environment Initiative

University of Colorado

Executive Board member (Elected position), Institute of Cognitive Science, University of Colorado, 1998-99 and 2001-03.

Search Committee member for Director of Institute of Cognitive Science, University of Colorado (2002-03).

Interim Program Chair, Educational Psychology, Fall, 1998.

Institute of Cognitive Science Curriculum Committee member, University of Colorado

Co-Chair, Search Committee for Science Education (Secondary Program), 2000-02

Co-Chair, Search Committee for Teaching and Learning to Teach/Ed Psych, 2001-02 Served on various Doctoral and Master's level thesis committees in Education (Educational Psychology and Instruction & Curriculum), Psychology, and Computer Science Depts.

Public School Outreach

Madison Metropolitan School District External Research Committee (2005-2011).

Madison Metropolitan School District (MMSD) Mathematics Task Force member (2007 to 2008).

Algebra Task Force member, Boulder (CO) Valley School District

Co-Director of the Working Shops Project for teacher professional development on technology in teaching, New Vista High School, Boulder (CO) Valley School District (1996-2003).

In-Service Presentations for Teacher Professional Development

Nathan, M. J. (2021, Dec.). "Instructional Gestures: Handy Ways to Promote Comprehension and Learning." Talk for the Seminar Series Enseñando con el Cerebro en Mente / Teaching with the Brain in Mind, for educational practitioners. Universidad de Chile, Santiago (Virtual).

Nathan, M. J. and Boncoddo, R. (2016-2017). Effective use of instructional gestures for promoting STEM integration. The Nevada Mathematics Project. Developed material and the overall training program for 4 week-long professional development workshops for statewide elementary grade teaching in math and integrated STEM.

Nathan, M. J. (2017, May) The role of the body in mathematics learning and teaching. East High School Mathematics Dept., Madison, WI. Met with teachers for a lunchtime PD session after speaking with their students on math learning.

Nathan, M. J. (2013, Jan). Teaching Integrated STEM Education: A 2-Day Workshop for Educators and Curriculum Developers. Institute for the Promotion of Teaching Science and Technology (IPST), Ministry of Education, Bangkok, Thailand.

Nathan, M. J. (2000, Aug). Students early algebra strategies: Lessons for teaching mathematics. In-service for middle and high school mathematics teachers, Boulder Valley School District.

Nathan, M. J. (1996, Oct). Students' many intelligences," Bollman Center, Thornton, CO (Leslie Trexlor, Talented and gifted program).

Nathan, M. J. (1994, Apr). Video-based tools for mathematical problem solving", and "Multimedia environments to support early reading and language acquisition." The Sandra Alpert Nathan Memorial Conference, Westport, CT. Kate McGraw, Assistant Superintendent for Special Education, Chair. This was an annual in-service workshop founded in memory of my mother who was a tireless special educator.