

KEVIN W. MCELHANEY

Senior Researcher, Science and Engineering Education
Center for Technology in Learning, SRI International
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EDUCATION

- 2010 **University of California, Berkeley**, Berkeley, CA
Ph.D. Education in Mathematics, Science, and Technology
Dissertation committee: Marcia Linn (advisor), Andrea diSessa, Michael Clancy
Dissertation title: *Making Controlled Experiments More Informative in Inquiry Investigations*
- 1999 **Harvard University**, Cambridge, MA
Ed.M. Teaching and Curriculum
- 1997 **Northwestern University**, Evanston, IL
M.S. Materials Science and Engineering
Thesis committee: Peter Voorhees (advisor), David Dunand, D. Lynn Johnson
Thesis title: *Determining the Three-Dimensional Morphology of Gamma Prime Particles in Nickel-Base Superalloys*
- 1996 **Stanford University**, Stanford, CA
B.S. Materials Science and Engineering, conferred with distinction
Research advisor: William Nix

PROFESSIONAL EXPERIENCE

- 2017 -
2013 - 2017 **Senior Researcher**, Center for Technology in Learning
Education Researcher, Center for Technology in Learning
SRI International, Menlo Park, CA
Projects: K-12 science, engineering, and computer science instruction, assessment, teacher professional development, and curriculum implementation, especially as aligned to national frameworks and standards
- 2010 - 2013 **Postdoctoral Scholar, Graduate School of Education**
University of California, Berkeley, Berkeley, CA
Supervisor: Marcia Linn
Projects: Visualizing to Integrate Science Understanding for All Learners (VISUAL); Continuous Learning and Automated Scoring in Science (CLASS)
- 2004 - 2010 **Graduate Student Researcher, Graduate School of Education**
University of California, Berkeley, Berkeley, CA
Advisor: Marcia Linn
Project: Technology-Enhanced Learning in Science (TELS)
- 2001 - 2004 **Teacher, Departments of Mathematics and Science**
Parkway North High School, Creve Coeur, MO

- 1999 - 2001 **Teacher, Departments of Mathematics and Science**
Saratoga High School, Saratoga, CA
- 1998 **Intern, Microsystems Technology Department**
Intel Corporation, Santa Clara, CA
- 1997 **Teaching Assistant, Department of Materials Science and Engineering**
Northwestern University, Evanston, IL
- 1996 - 1997 **Research Assistant, Department of Materials Science and Engineering**
Northwestern University, Evanston, IL
- 1995 - 1996 **Research Assistant, Department of Materials Science and Engineering**
Stanford University, Stanford, CA

PUBLICATIONS: REFEREED JOURNAL ARTICLES

- Linn, M. C., Gerard, L., Matuk, C., & **McElhane, K. W.** (2016). Science Education: From Separation to Integration. *Review of Research in Education*, 40(1), 529-587.
- Matuk, C., **McElhane, K.W.**, King Chen, J., Lim-Breitbart, J., Kirkpatrick, D. & Linn, M. C. (2016). Iteratively refining a science explanation tool through classroom implementation and stakeholder partnerships. *International Journal of Designs for Learning*, 7(2), 93-110.
- Gerard, L. F., Ryoo, K., **McElhane, K. W.**, Liu, O. L., Rafferty, A. N., & Linn, M. C. (2016). Automated guidance for student inquiry. *Journal of Educational Psychology*, 108(1), 60.
- McElhane, K.W.**, Chang, H.-Y., Chiu, J.L. & Linn, M.C. (2015). Evidence for effective uses of dynamic visualisations in science curriculum materials. *Studies in Science Education*, 51(1), 49-85.
- Gerard, L., Matuk, C., **McElhane, K.W.**, & Linn, M.C. (2015). Automated, adaptive guidance for K-12 education. *Educational Research Review*, 15, 41-58.
- Linn, M. C., Gerard, L., Ryoo, K., **McElhane, K.W.**, Liu, O. L., & Rafferty, A. N. (2014). Computer-Guided Inquiry to Improve Science Learning. *Science*, 344(6180), 155-156.
- McElhane, K.W.** & Linn, M.C. (2011). Investigations of a Complex, Realistic Task: Intentional, Unsystematic, and Exhaustive Experimenters. *Journal of Research in Science Teaching*, 48(7), 745-770.
- McElhane, K.W.** (2004). Demonstrating Boolean Logic Using Simple Electrical Circuits. *Mathematics Teacher*, 97(2), 126-34.
- McElhane, K.W.** & Ma, Q. (2004). Investigation of Moisture-Assisted Fracture in SiO₂ Films Using a Channel Cracking Technique. *Acta Materialia*, 52(12), 3621-9.

McElhaney, K.W. & Voorhees, P.W. (2000). Determining the Three-Dimensional Morphology of γ' Precipitates in γ - γ' Superalloys. *Metallurgical and Materials Transactions A*, 31(5), 1333-42.

McElhaney, K.W., Vlassak, J.J., & Nix, W.D. (1998). Determination of Indenter-tip Geometry and Indentation Contact Area for Depth-Sensing Indentation Experiments. *Journal of Materials Research*, 13(5), 1300-6.

PUBLICATIONS: CONFERENCE PROCEEDINGS

McElhaney, K.W., Vaishampayan, G., D'Angelo, C., Harris, C. J., Pellegrino, J. W., & Krajcik, J. (2016). Using learning performances to design science assessments that measure knowledge-in-use. In C. K. Looi, J. L. Polman, U. Cress, & P. Reiman (Eds.). *Transforming learning, empowering learners: Proceedings of the 12th International Conference of the Learning Sciences* (pp. 1211-1212). International Society of the Learning Sciences: Singapore.

Tate, E.D., Feng, M., & **McElhaney, K.W.** (2016). Designing the Idea Manager to Integrate STEM Content and Practices During a Technology-Based Inquiry Investigation. In C. K. Looi, J. L. Polman, U. Cress, & P. Reiman (Eds.). *Transforming learning, empowering learners: Proceedings of the 12th International Conference of the Learning Sciences* (pp. 210-217). International Society of the Learning Sciences: Singapore.

Rafferty, A. N., Gerard, L., **McElhaney, K.**, and Linn, M. C. (2014). Promoting Student Learning Through Automated Formative Guidance on Chemistry Drawings. *Proceedings of the 11th International Conference of the Learning Sciences* (pp. 386-393). International Society of the Learning Sciences: Boulder, CO.

McElhaney, K.W., Matuk, C.F., Miller, D.I. & Linn, M.C. (2012). Using the Idea Manager to Promote Coherent Understanding of Inquiry Investigations. In J. van Aalst, B. Reiser, C. Hmelo-Silver, K. Thompson (Eds.). *The Future of Learning: Proceedings of the 10th International Conference of the Learning Sciences*. International Society of the Learning Sciences: Sydney, Australia.

McElhaney, K.W. & Linn, M.C. (2010). Helping Students Make Controlled Experiments More Informative. In K. Gomez, L. Lyons, J. Radinsky (Eds.). *Learning in the Disciplines: Proceedings of the 9th International Conference of the Learning Sciences, Volume 1* (pp. 786-793). International Society of the Learning Sciences: Chicago, IL.

McElhaney, K.W. & Linn, M.C. (2008). Impacts of students' experimentation using a dynamic visualization on their understanding of motion. In G. Kanselaar, V. Jonker, P. Kirschner, F. Prins (Eds.) *International Perspectives in the Learning Sciences: Creating a Learning World. Proceedings of the 8th International Conference of the Learning Sciences, Volume 2* (pp. 51-58). International Society of the Learning Sciences: Utrecht, The Netherlands.

PUBLICATIONS: BOOK CHAPTERS

Linn, M.C., **McElhane, K.W.**, Gerard, L., Matuk, C.F. (in press). Inquiry Learning and Opportunities for Technology. In F. Fischer, C. E. Hmelo-Silver, P. Reimann & S. Goldman (Eds.), *International Handbook of the Learning Sciences*. Routledge.

McElhane, K.W. & Linn, M.C. (2012). Orchestrating Inquiry Using the Knowledge Integration Framework. In K. Littleton, E. Scanlon, & M. Sharples (Eds.), *Orchestrating Inquiry Learning*. New York: Routledge.

Linn, M. C., Chang, H. - Y., Chiu, J., Zhang, H., & **McElhane, K.** (2010). Can desirable difficulties overcome deceptive clarity in scientific visualizations? In A. Benjamin (Ed.), *Successful remembering and successful forgetting: a Festschrift in honor of Robert A. Bjork* (pp. 239–258). New York: Routledge.

Clark, D. B., Varma, K., **McElhane, K.W.**, & Chiu, J.L. (2008). Design Rationale Within TELS Projects To Support Knowledge Integration. In D. Robinson & G. Schraw (Eds.), *Recent Innovations in Educational Technology That Facilitate Student Learning* (pp. 157-193). Charlotte, NC: Information Age Publishing.

PUBLICATIONS: REPORTS

Harris, C. J., Krajcik, J. S., Pellegrino, J. W., & **McElhane, K.W.** (2016). *Constructing assessment tasks that blend disciplinary core ideas, crosscutting concepts, and science practices for classroom formative applications*. Menlo Park, CA: SRI International.

CONFERENCE PRESENTATIONS

McElhane, K.W., Gane, B., diBello, L.V., Fujii, R., Pennock, P.H, Vaishampayan, G., Pellegrino, J.W. (2017, May). Designing Scoring Rubrics to Support NGSS-aligned, Classroom-based Formative Assessment. Paper presented at the American Educational Research Association Annual Meeting, San Antonio, TX.

King Chen, J. Y., **McElhane, K. W.**, Kirkpatrick, D., & Linn, M. C. (2017, April). Balancing between tradeoffs: Iterative design of inquiry learning visualizations to support sense-making and conceptual understanding. Paper presented at the annual meeting of the American Educational Research Association, San Antonio, TX.

Gane, B., **McElhane, K.W.**, Harris, C., J, Pellegrino, J.W., Krajcik, J.S. (2017, March). Classroom-Based Assessment Tasks and Rubrics: Using Student Responses as Evidence of Three-Dimensional Learning. Presentation given at the annual meeting of the National Association for Research in Science Teaching, Los Angeles, CA.

McElhane, K. W., Gane, B. D., Harris, C. J., Pellegrino, J. W., DiBello, L. V., & Krajcik, J. S (2016, April). *Using learning performances to design three-dimensional assessments of science proficiency*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Baltimore, MD.

Tate, E.D., Feng, M., & **McElhane, K.W.** (2016, April). Analysis of middle school students' knowledge integration about trait expression during a technology-based science inquiry investigation. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Baltimore, MD.

McElhane, K.W., Harris, C. J., Peek-Brown, D., Gane, B., & Damelin, D. (2016, March). *Strategies for using NGSS-focused physical science assessment tasks formatively in classrooms*. Presentation given at the National Science Teachers Association National Conference, Nashville, TN.

McElhane, K.W., deBarger, A.H., D'Angelo, C.M., Harris, C.J., Seeratan, K.L., & Stanford, T.M. (2015, April). Integrating Crosscutting Concepts into 3-Dimensional Scoring Rubrics. Paper presented at the NARST Annual International Conference, Chicago, IL.

Fujii, R., Werner, A., DeBarger, A., **McElhane, K.W.** (2015, April) Exploring the Role of Facet-Based Items in Next Generation Science Assessment. Paper presented at the NARST Annual International Conference, Chicago, IL.

Seeratan, K., Stanford, T., **McElhane, K. W.**, McGhee, R., Harris, C. J., Conger, D., & Long, M. C. (2014, November). Measuring high school students' scientific inquiry skills. Paper presented at the annual conference of the Association for Public Policy Analysis and Management, Albuquerque, NM.

McElhane, K.W., Gerard, L.F., Rafferty, A., Zertuche, A., & Linn, M.C. (2013, April). Comparing the Benefits of Automated and Teacher Feedback on Student-generated Molecular Representations. *Paper presented at the American Educational Research Association Annual Meeting, San Francisco, CA.*

McElhane, K.W., Chang, H.-Y., Chiu, J.L. & Linn, M.C. (2013, April). Meta-analysis of the Benefits of Dynamic and Static Visualizations for Science Learning. *Paper presented at the American Educational Research Association Annual Meeting, San Francisco, CA.*

Matuk, C. F., **McElhane, K.**, King Chen, J., Miller, D., Lim-Breitbart, J., & Linn, M. C. (2012, July). The Idea Manager: A tool to scaffold students documenting, sorting, and distinguishing ideas in science inquiry. Poster presented at *10th International Conference of the Learning Sciences, Sydney, Australia.*

McElhane, K.W. & Linn, M.C. (2011, July). Comparing Students' Verbal Descriptions, Static Drawings, and Animated Representations of Chemical Phenomena. *Poster presented at the Gordon Research Conference on Visualization in Science and Education, Smithfield, RI.*

King Chen, J., Tinker, R., **McElhane, K.** (2011, April). Supporting Student Understanding of Projectile and Orbital Motion with Dynamic Models. *Poster presented at the annual meeting of the American Educational Research Association, New Orleans, LA.*

Matuk, C., **McElhane**y, K., & Linn, M. (2010, December). Using Visualizations to Link Atomic Views of Matter to Students' Everyday Ideas About Science. *Poster presented at the NSF DR-K12 PI Meeting, Washington, DC.*

Linn, M., Tinker, R., Chiu, J., King Chen, J., Matuk, C., **McElhane**y, K., Miller, D. Swanson, H., Zhang, H. (2010, December). Visualizing to Integrate Science Understanding for All Learners (VISUAL). *Poster presented at the DR-K12 PI Meeting, Washington, DC.*

McElhaney, K.W. (2010, June). Using Visualizations to Help Students Investigate Realistic Experimentation Contexts. *Poster presented at the 9th International Conference of the Learning Sciences, Chicago, IL.*

McElhaney, K.W. & Linn, M.C. (2010, April). What Can Students Learn by Comparing Rather Than Isolating Variables? *Paper presented at the American Educational Research Association Annual Meeting, Denver, CO.*

McElhaney, K.W. & Linn, M.C. (2009, April). How Should Instruction Guide Students Toward Conducting Informative Experiments? *Paper presented at the National Association of Research in Science Teaching Annual Conference, Garden Grove, CA.*

McElhaney, K.W. (2008, June). Connecting students' experimentation strategies with a dynamic visualization and their domain knowledge. *Poster presented at the 8th International Conference of the Learning Sciences, Utrecht, The Netherlands.*

McElhaney, K.W. (2007, April). Relating Students' Experimentation with a Visualization to Their Understanding of Kinematics. *Poster presented at the annual meeting of American Educational Research Association, Chicago, IL.*

McElhaney, K.W. (2007, April). Using Pivotal Cases to Help Learners Understand and Integrate Chemistry Representations. *Poster presented at the annual meeting of American Educational Research Association, Chicago, IL.*

McElhaney, K.W. (2007, April). Examining the relationship between students' experiments with a computer-based visualization and their learning gains in diverse classroom settings. *Poster presented at the annual meeting of American Educational Research Association, Chicago, IL.*

McElhaney, K.W. (2006, February). What is the role of students' experimentation patterns in learning from interactive visualizations? *Poster presented at the NSF Centers for Learning and Teaching Principal Investigator Meeting, Washington, DC.*

McElhaney, K.W. (2005, February). Using dynamic models to improve students' understanding of motion graphs. *Poster presented at the Centers for Learning and Teaching Principal Investigator Meeting, Washington, DC.*

WORKSHOPS & SYMPOSIA

(2012) Technology Enhanced Learning in Science Community. Teacher Professional Development Workshop, University of California, Berkeley.

(2011) Technology Enhanced Learning in Science Community. Teacher Professional Development Workshop, University of California, Berkeley.

Matuk, C., **McElhane**y, K., & Breitbart, J. (2011). *Animating ideas with the Flipbook Animator*. Interactive breakout session presented at the Cyberlearning Tools for STEM Education Conference. Berkeley, CA, March 8-9.

(2010) Technology Enhanced Learning in Science Community. Teacher Professional Development Workshop, University of California, Berkeley.

McElhaney, K.W. & Chiu, J.L., (2007). Using Technology-Mediated Visualizations to Support Chemistry Learning. *Interactive poster session at the annual meeting of American Educational Research Association*, Chicago, IL, April 9-13.

INVITED TALKS

McElhane

y, K.W. (2013, March 25). Using the Idea Manager to Promote and Assess Coherent Understanding of Inquiry Investigations. Center for Technology in Learning, SRI International, Menlo Park, CA.

McElhane

y, K.W. (2012, April 3). Promoting Informative Experimentation in Technology-Enhanced Inquiry Investigations. Invited talk given at the Education in Mathematics, Science, and Technology Colloquium Series, Graduate School of Education, University of California, Berkeley.

McElhane

y, K.W. (2012, February 21). Making Virtual Experimentation More Informative in Inquiry Investigations. Invited talk given for the graduate course EDUC 220C: Designing Educational Technologies, Graduate School of Education, University of California, Berkeley.

McElhane

y, K.W. (2012, January 30). Designing Technology-Enhanced Inquiry Instruction to Promote Coherent Science Understanding. Invited talk given at the Graduate School of Education, University of Colorado, Boulder.

UNPUBLISHED MANUSCRIPTS

McElhane

y, K.W. (2010). *Making Controlled Experimentation More Informative in Inquiry Investigations*. Unpublished doctoral dissertation, University of California, Berkeley.

McElhane

y, K.W. (1999). *Determining the Three-Dimensional Morphology of Gamma Prime Particles in Nickel-Base Superalloys*. Unpublished Master's thesis, Northwestern University.

GRANTS

Biswas, G., Grover, S., **McElhane, K.W.**, Schwarz, D., Ledeczi, A., (\$2,499,682, September 15, 2016 – September 14, 2019). *Research and Assessment on Synergistic Learning of Physics and Programming through Computational Modeling and Problem Solving*. National Science Foundation STEM + Computing Award DRL-1640199. Co-Principal Investigator.

AWARDS & FELLOWSHIPS

- 2014 - 2016 SRI International SPOT award for achievements exemplifying SRI's core values
- 2011 JRST paper (McElhane & Linn, 2011) selected by NARST Publications Advisory Committee for the NSTA reading list based on relevance and readability for science teachers
- 2010 Nominee, Outstanding Graduate Student Paper Award, International Conference of the Learning Sciences
- 2009 - 2010 Spencer Dissertation Fellowship, Spencer Foundation
- 2006 - 2008 Continuing Student Fellowship, University of California, Berkeley
- 2006 Graduate Research Fellowship Honorable Mention, National Science Foundation
- 2005 - 2006 Spencer Research Training Fellowship, University of California, Berkeley
- 2004 - 2005 University Fellowship, University of California, Berkeley
- 1998 - 1999 Rockefeller Fellowship, Graduate School of Education, Harvard University
- 1997 Graduate Research Fellowship, United States Department of Defense
- 1996, 1997 Graduate Research Fellowship Honorable Mention, National Science Foundation
- 1996 Royal E. Cabell Fellowship, School of Engineering, Northwestern University
- 1996 Welton J. Crook Award, Department of Materials Science and Engineering, Stanford University
- 1995 Summer Undergraduate Research Fellowship, School of Engineering, Stanford University

CURRICULAR INNOVATIONS

- 2014 **How Can Genetics Help Increase Fuel Resources?**
High school life science unit on genetics developed with the Web-based Inquiry Science Environment.
- 2010 **Idea Basket and Explanation Builder**

Interactive tools developed for the Web-based Inquiry Science Environment that help students organize scientific ideas and generate coherent scientific explanations

- 2006 **How Can We Recycle Old Tires?**
High school chemistry unit on atomic bonding developed with the Web-based Inquiry Science Environment
- 2005 **Airbags: Too Fast, Too Furious?**
High school physics unit on motion and graphs developed with the Web-based Inquiry Science Environment
- 2004 **Demonstrating Boolean Logic Using Simple Electrical Circuits**
High school mathematics unit designed to help students connect the concepts of Boolean logic operators and electric circuits

PROFESSIONAL ACTIVITIES

Professional Memberships

American Educational Research Association (AERA), National Association for Research in Science Teaching (NARST), National Science Teachers Association (NSTA), International Society of the Learning Sciences (ISLS)

Ad-hoc reviewer

Journal of the Learning Sciences, Journal of Research in Science Teaching, Journal of Engineering Education