JOHN J. CLEMENT

clement@umass.edu

Education:

1964-1968 Harvard University, Bachelor's degree in Physics (cum laude), 1968.

1975-1976 Visiting Scholar, Committee on Culture and Cognition, University of Illinois. Conducted research on case studies of students' mathematical thinking under J. Easley.

1973-1976 University of Massachusetts, Amherst. Doctorate in Science and Mathematics Education, Graduate School of Education, 1977.

Professional positions:

1997- present Professor, Science Education, College of Education, University of Massachusetts, Amherst. (Emeritus since 2010)

1987-present Senior Research Director, Scientific Reasoning Research Institute, College of Natural Sciences and Mathematics.

Research:

Chronology of Research Interests

(The following projects have been supported by 10 grants I received from NSF, beginning in 1985, and by grants with others)

Expert Reasoning and Model Construction

I have studied expert reasoning in science in areas such as model construction, analogy, imagery, and mental simulation. This work, based on think-aloud interviews with experts solving explanation problems, focuses on the nature of creative, imagery-based nonformal reasoning processes that may be as or more important for innovation than formal deductive reasoning. This includes papers in early meetings of the Cognitive Science Society (e.g. Clement (1981), an article on spontaneous analogy generation methods (Clement, 1988, in *Cognitive Science*), a chapter on the use of physical intuition and imagistic simulation by experts (Clement, 1994), a book on the role of imagery and mental simulation in expert analogy making and model construction (Clement, 2008, Springer), an article on the role of mental simulation in expert reasoning and thought experiments (Clement, 2009, in *Topics in Cognitive Science*), a chapter on the role of imagery in analogy use (Clement, 2009), an article on parallel reasoning patterns in Galileo's analysis of machines and in expert protocols (Clement, 2018, in *Topoi),* and an article on multiple levels of heuristic reasoning processes in scientific model construction (Clement, 2002, in *Frontiers in Psychology, Cognition*) that consolidates heuristics from three think-aloud and history of science studies and places them into four, nested, hierarchical levels. These studies provide evidence from case studies that there are creative, rationalistic, qualitative reasoning patterns and heuristics that are grounded in perceptual motor processes involving imagery. These findings have important applications in theories of science learning and instruction described below.

Intuitive Knowledge Structures, Mental Models, and Scientific Thinking in Students

Mathematics Conceptions: Early in my career I also did some work on students' mathematical thinking skills, leading to publications on intuitive conceptions of division in 8 year olds, conceptions of variables and equations in college students, and conceptions of graphing, as well as basic problem solving skills. Since then I've focused on applications to cognitive issues in science learning.

Alternative Conceptions: A paper which helped initiate the study of persistent alternative conceptions as a research area is Clement (1982). These studies document certain thinking patterns that can be constrained or dominated by domain specific knowledge schemas. This contributed to the beginning of a shift in the psychology of learning from an emphasis on general reasoning skills to the inclusion of prior knowledge schemas as an important factor in learning, helping lay the groundwork for theories of mental models.

Useable Intuitions in Students: Other papers in that vein were followed by a complementary publication titled "Not All Preconceptions are Misconceptions" documenting students' positive conceptions or "anchoring intuitions." This was an effort to document students' intuitive conceptions that can be built upon in instruction (Clement, Brown, and Zietsman, 1989; Clement, 1993). This research led to two curriculum projects. "Preconceptions in Mechanics" is a set of lessons specifically designed to deal with alternative conceptions through the use of visual reasoning, problem solving, key analogy sequences, and classroom discussion (Camp, Clement, et al, 1994, second edition, 2010). We were able to document large gain differences over control groups for this curriculum (Clement, 1993; Brown & Clement, 1991)

Model Based Learning and Scientific Thinking Skills in Classrooms: Our team has done classroom studies on strategies for leading discussions about animated simulations in science. It has also documented strategies for fostering scientific thinking in students, including the role of imagistic mental simulations and whole class discussion modes. The teaching strategies are designed to foster scientific practices, and build on our research on expert reasoning and model construction practices described above.

Citations:

>12,000 citations in Google Scholar

Publications: Books

Clement, J., (2008). *Creative model construction in scientists and students: The role of imagery, analogy, and mental simulation.* Dordrecht: Springer. 630 pages, softcover edition, 2009. ISBN: 904813023997890481302 38. This monograph presents a theory of imagery based conceptual learning and creativity in science that was developed from a data base of think aloud protocols from experts. Parallels to model construction by students are discussed as well.

Clement, John, Rea-Ramirez, Mary Anne, Editors (2008). *Model based learning and instruction in science*. Dordrecht: Springer. ISBN: 978-1-4020-6493-7 Edited collection of chapters by our research team which describes new, model based teaching methods in science instruction and presents research results on their characteristics and effectiveness.

Lochhead, J. and Clement, J. (Eds.) (1979). *Cognitive process instruction.* Hillsdale, NJ: Lawrence Erlbaum Associates. ISBN: 978-1-931024-13-6 This book grew out of one of the first conferences in the area of applications of work on cognition to instruction which

was held at the U. of Massachusetts, Amherst. It was one of the first edited volumes in that area.

Cognitive Science Papers

Clement, J. J. (2022). Multiple levels of heuristic reasoning processes in scientific model construction. *Frontiers in Psychology*, *Cognition*, *13*. (Open access.) doi:10.3389/fpsyg.2022.750713
https://www.frontiersin.org/articles/10.3389/fpsyg.2022.750713/full

Clement, J. J. (2018). Reasoning patterns in Galileo's analysis of machines and in expert protocols: Roles for analogy, imagery, and mental simulation. *Topoi*, 1-13.
PDF

Clement, J. (2009). Analogical reasoning via imagery: The role of transformations and simulations. In B. Kokinov, K. Holyoak, and D. Gentner, *New frontiers in analogy research*. Sofia: New Bulgarian University Press.
Adobe PDF - 353K

Clement, J. (2009). The role of imagistic simulation in scientific thought experiments. *TOPICS in Cognitive Science*, 1: 686-710.
http://onlinelibrary.wiley.com/doi/10.1111/j.1756-8765.2009.01031.x/epdf

Clement, J., (2008). *Creative model construction in scientists and students: The role of imagery, analogy, and mental simulation.* Dordrecht: Springer. 630 pages; softcover or electronic edition, 2009. ISBN: 904813023997890481302 38. This monograph presents a theory of imagery based conceptual learning and discovery in scientists that was developed from a data base of think aloud protocols. It also compares expert thinking with student thinking.

Clement, J. (2006). Thought experiments and imagery in expert protocols. In L. Magnani, ed., *Model-based reasoning in science and engineering*, (pp.1-16). London: King's College Publications.
PDF - 230K

Clement, John (2004). Imagistic processes in analogical reasoning: Conserving transformations and dual simulations. *Proceedings of the Twenty-Sixth Annual Conference of the Cognitive Science Society*. Mahwah, NJ: Erlbaum.
PDF File - 600K

Clement, J. (2003). Imagistic simulation in scientific model construction. *Proceedings of the Twenty-Fifth Annual Conference of the Cognitive Science Society, 25.* Mahwah, NJ: Erlbaum.
PDF File - 175K

Clement, J. (2002). Protocol evidence on thought experiments used by experts. In Wayne Gray and Christian Schunn, Eds., *Proceedings of the Twenty-Fourth Annual Conference of the Cognitive Science Society.* Mahwah, NJ: Erlbaum, 2002.
Microsoft Word file - 50K PDF- 80K

Clement, J. (1994). *Use of physical intuition and imagistic simulation in expert problem solving*. Tirosh, D. (Eds.), Implicit and explicit knowledge. Norwood, NJ: Ablex Publishing Corp.
PDF - 1M

Clement, J. (1994). Imagistic simulation and physical intuition in expert problem solving. In *The Sixteenth Annual Meeting of the Cognitive Science Society*, Lawrence Erlbaum, Hillsdale, NJ.
PDF - 560K

Clement, J. (1993). Model construction and criticism cycles in expert reasoning. In the *Proceedings of the Fifteenth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Lawrence Erlbaum.
PDF - 400K

Steinberg, M. S., and Clement, J. (1990). Genius is not immune to misconceptions: conceptual difficulties impending Isaac Newton and contemporary physics students. *International Journal of Science Education*,12: 265-273.
PDF - 600K

Clement, J. (1989). Learning via model construction and criticism: protocol evidence on sources of creativity in science. Glover, J., Ronning, R., and Reynolds, C. (Eds.), *Handbook of creativity: Assessment, theory and research*. NY: Plenum, 341-381.
PDF - 1.1M

Clement, J. (1988). Observed methods for generating analogies in scientific problem solving. *Cognitive Science*, 12: 563-586.
PDF - 1.1M

Clement, J. (1986). Methods used to evaluate the validity of hypothesized analogies. *Proceedings of the Ninth Annual Meeting of the Cognitive Science Society*. Hillsdale, NJ: Lawrence Erlbaum Associates.
PDF - 600K

Clement, J. (1983). A conceptual model discussed by Galileo and used intuitively by physics students. Gentner, D., and Stevens, A.L. (Eds.), *Mental models*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Clement, J. (1982). Students' preconceptions in introductory mechanics. *The American Journal of Physics*, 50(1), 66-71.
PDF - 400K

Clement, J. (1982). Analogical reasoning patterns in expert problem solving. *Proceedings of the Fourth Annual Meeting of the Cognitive Science Society*, Ann Arbor.
PDF - 360K

Clement, J. (1981). Analogy generation in scientific problem solving. *Proceedings of the Third Annual Meeting of the Cognitive Science Society*, Berkeley, CA. ERIC RIE #SE-048-920.
PDF

Papers in Learning Theory and Cognition in Instruction in Science and Mathematics

Nunez-Oviedo, M. and Clement, J. (2019). Large scale scientific modeling practices that can organize science instruction at the unit and lesson levels. *Frontiers in Education,* 4:68, doi: 10.3389/feduc.2019.00068. (Open Access: Link)

Williams, G. and Clement, J. (2019). Co-constructing models through whole class discussions in high school physics. In J. Harrell, J. Shemwell, and D. Sunai, *Physics teaching and learning: Challenging the paradigm* (pp. 85-109). Charlotte, NC: Information Age Publishing.

Price, N., Stephens, A. L., Clement, J., & Nunez-Oviedo, M. (2017). Using imagery support strategies to develop powerful imagistic models. *Science Scope, 41*(4), 40-49. PDF 1.2 MB

Stephens, L., & Clement, J. (2015). Use of physics simulations in whole class and small group settings: Comparative case studies. *Computers & Education*, 86, 137-156.

Williams, G., & Clement, C. (2015). Identifying multiple levels of discussion-based teaching strategies for constructing scientific models. *International Journal of Science Education, 37*(1), 82-107. http://www.tandfonline.com/doi/abs/10.1080/09500693.2014.966257

Price, N., & Clement, J. (2014). Generating, evaluating, and modifying scientific models using projected computer simulations. *Science Scope*,*038*(02). doi:10.2505/4/ss14_038_02_39norm

Clement, J. (2013). Roles for explanatory models and analogies in conceptual change. In S. Vosniadou (Ed.), *International handbook of research on conceptual change, Second Edition*. New York: Routledge.

Stephens, L. and Clement, J. (2012). The role of thought experiments in science learning. In K. Tobin, C. McRobbie, and B. Fraser, *International Handbook of Science Education, Vol. II*. Dordrecht: Springer. http://link.springer.com/chapter/10.1007/978-1-4020-9041-7_13

Price, N., Leibovitch, A., and Clement, J. (2011). Teaching strategies for using simulations in the classroom: A descriptive case study. In I. Saleh & M.S. Khine (Eds.), *Practitioner Research: Teachers' Investigations in Classroom Teaching.* Hauppauge, New York: Nova Science Publishers.

Stephens, L. & Clement, J. (2010). Documenting the use of expert scientific reasoning processes by high school physics students. *Physical Review Special Topics - Physics Education Research, 6(2): URL: http://link.aps.org/doi/10.1103/PhysRevSTPER.6.020122*

Rea-Ramirez, M., Nunez-Oviedo, M., and Clement, J. (2009). The role of discrepant questioning leading to model element modification. *Journal of Science Teacher Education*, 20(2), 95.

Clement, John, Rea-Ramirez, Mary Anne, Editors (2008). *Model based learning and instruction in science.* Dordrecht: Springer.

Clement, J. (2008). Six levels of organization for curriculum design and teaching. In J. Clement & M. A. Rea-Ramirez (Eds.), *Model based learning and instruction in science* (pp. 255-272). Dordrecht: Springer.

Clement, J. (2008). Student/teacher co-construction of visualizable models in large group discussion. In J. Clement & M. A. Rea-Ramirez (Eds.), *Model based learning and instruction in science* (pp. 11-22). Dordrecht: Springer.

Clement, J. & Steinberg, M. (2008). Case study of model evolution in electricity: Learning from both observations and analogies. In J. Clement & M. A. Rea-Ramirez (Eds.), *Model based learning and instruction in science* (pp. 103-116). Dordrecht: Springer.

Else, M., Clement, J. & Rea-Ramirez, M. A. (2008). Using analogies in science teaching and curriculum design: Some guidelines. In J. Clement & M. A. Rea-Ramirez (Eds.), *Model based learning and instruction in science* (pp. 215-232). Dordrecht: Springer.

Nunez-Oviedo, M. C. & Clement, J. (2008). A competition strategy and other discussion modes for developing mental models in large group discussion. In J. Clement & M. A. Rea-Ramirez (Eds.), *Model based learning and instruction in science* (pp. 117-138). Dordrecht: Springer.

Nunez-Oviedo, M. C., Clement, J. & Rea-Ramirez, M. A. (2008). Developing complex mental models in biology through model evolution. In J. Clement & M. A. Rea-Ramirez (Eds.), *Model based learning and instruction in science* (pp. 173-194). Dordrecht: Springer.

Rea-Ramirez, M. A., Clement, J. & Nunez-Oviedo, M. C. (2008). An instructional model derived from model construction and criticism theory. In J. Clement & M. A. Rea-Ramirez (Eds.), *Model based learning and instruction in science* (pp. 23-44). Dordrecht: Springer.

Clement, J., Zietsman, A., and Monaghan, J. (2005). Imagery in science learning in experts and students. In Gilbert, J., Visualization in science education (pp. 169-184). Dordrecht: Springer.

Clement, J. and Steinberg, M. (2002) Step-wise evolution of models of electric circuits: A "learning-aloud" case study. Journal of the Learning Sciences 11(4), 389-452.

Steinberg, M. and Clement, J. (2001). Evolving mental models of electric circuits. In Behrendt, H. et al. (eds.), Research in science education—Past, present, and Future, 235-240. Dordrecht: Kluwer.

Richard Yuretich, Samia Khan, Mark Lecky, and John Clement (2001). Active-learning methods improve student performance and scientific interest in a large introductory oceanography course. Journal of Geoscience Education, March, 2001.

Clement, J. (2000) Model based learning as a key research area for science education. International Journal of Science Education 22(9), 1041-1053..

Monaghan, J. M. & Clement, J. (2000). Algorithms, visualization, and mental models: High school students' interactions with a relative motion simulation. Journal of Science Education and Technology, 9 (4), 311-325.

Clement, J. (2000) Analysis of clinical interviews: Foundations and model viability. In A. Kelly and R. Lesh, (Eds), *Handbook of research design in mathematics and science education* (pp. 547-590). Mahwah, NJ: Lawrence Erlbaum. ISBN: ISBN-0-8058-3281-5

Monaghan, J. M. & Clement, J. (1999). Use of a computer simulation to develop mental simulations for learning relative motion concepts. International Journal of Science Education, 21(9), 921-944.

Gobert, J. & Clement, J. (1999). The effects of student-generated diagrams versus student-generated summaries on conceptual understanding of spatial, causal, and dynamic knowledge in plate tectonics. Journal of Research in Science Teaching, 36(1), 39-53.

Clement, J. (1998). Expert novice similarities and instruction using analogies. International Journal of Science Education, 20(10), 1271-1286.

Zietsman, A. and Clement, J. (1997). The role of extreme case reasoning in instruction for conceptual change. Journal of the Learning Sciences, 6(1), 61-89.

Schultz, K. and Clement, J. (1994). The use of class discussion and analogies in teaching: Examples from one physics classroom. In C. Camp, et al., Preconceptions in mechanics: Lessons dealing with conceptual difficulties. Dubuque, Iowa: Kendall Hunt.

Clement, J. (1993). Using bridging analogies and anchoring intuitions to deal with students' preconceptions in physics. Journal of Research in Science Teaching, 30(10), 1241-1257.

Brown, D., & Clement, J. (1991). Classroom teaching experiments in mechanics. In R. Duit, F. Goldberg, & H. Niedderer (Eds.), Research in physics learning - theoretical issues and empirical studies. San Diego, CA: San Diego State University.

Clement, J. (1991). Non-formal reasoning in science: The use of analogies, extreme cases, and physical intuition. In Voss, J., Perkins, D., & Segal, J. (Eds.), Informal reasoning and education. Hillsdale, NJ: Lawrence Erlbaum Associates.

Clement, J. (1991). Constructivism in the classroom, review of Steffe and T. Wood (Eds.), Transforming children's mathematics education, in Journal for Research in Mathematics Education, 22(5), 422-428.

Steinberg, M. Brown, D. & Clement J. (1990). Genius is not immune to persistent misconceptions: Conceptual difficulties impeding Isaac Newton and contemporary physics students. International Journal of Science Education, 12, 265-273.

Murray, T., Schultz, K., Brown, D., and Clement, J. (1990). An analogy-based computer tutor for remediating science misconceptions. Journal of Interactive Learning Environments, 1(2).

Clement, J., Brown, D., and Zietsman, A. (1989). Not all preconceptions are misconceptions: Finding anchoring conceptions for grounding instruction on students' intuitions. International Journal of Science Education, 11: 554-565.

Brown, D., and Clement, J. (1989). Overcoming misconceptions via analogical reasoning: Factors influencing understanding in a teaching experiment., Instructional Science, 18: 237-261.

Clement, J. (1989). The concept of variation and misconceptions in Cartesian graphing. Focus on Learning Problems in Mathematics, 11(2), 77-87.

Clement, J. and Konold, C., (1989). Fostering basic problem-solving skills in mathematics. For the Learning of Mathematics, 9(3), pp. 26-30.

Clement, J. (1987). Generation of spontaneous analogies by students solving science problems. Topping, D., Crowell, D., and Kobayashi, V. (Eds.), Thinking across cultures. Hillsdale, NJ: Lawrence Erlbaum Associates, 303-308.

Clement, J. (1982). Students' preconceptions in introductory mechanics. The American Journal of Physics, 50(1), 66-71.

Soloway, E., Lochhead, J., and Clement, J. (1982). Does computer programming enhance problem solving ability? Some positive evidence on algebra word problems. Seidel, R.J., Anderson, R.E., and Hunter, B. (Eds.), Computer literacy: Issues and directions for 1985. New York: Academic Press.

Clement, J. (1982). Algebra word problem solutions: Thought processes underlying a common misconception. Journal for Research in Mathematics Education, 13(1), 16-30.

Clement, J., Lochhead, J., and Monk, G. (1981). Translation difficulties in learning mathematics. American Mathematical Monthly, 88(4), 286-290.

Clement, J. (1981). Cognitive microanalysis: an approach to analyzing intuitive mathematical reasoning processes. In Wagner, S., & Geeslin, W. (Eds.), Modeling Mathematical Cognitive Development, ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Ohio State University.

Clement, J., Narode, R., and Rosnick, P. (1981). Intuitive misconceptions in algebra as a source of math anxiety, Focus on Learning Problems in Mathematics, 3(4), 36-45.

Clement, J. (1981). Solving Problems with formulas: Some limitations. Engineering Education, 72(2), 158-162.

Fredette, N, and Clement, J. (1981). Students' misconceptions of an electric circuit: What do they mean? Journal of College Science Teaching, 10(5), 280-285.

Clement, J. (1981). Students' preconceptions in physics and Galileo's discussion of falling bodies. Problem Solving, 3(1), 3-5.

Rosnick, P., and Clement, J. (1980). Learning without understanding: The effect of tutoring strategies on algebra misconceptions. Journal of Mathematical Behavior, 3(1), 3-27.

Clement, J. (1979). Introduction to research in cognitive process instruction. Lochhead, J. and Clement, J. (Eds.), Cognitive process instruction. Hillsdale, NJ: Lawrence Erlbaum Associates.

Clement, J. (1979). Mapping a student's causal conceptions from a problem solving protocol. Lochhead, J. and Clement, J. (Eds.), Cognitive process instruction, Hillsdale, NJ: Lawrence Erlbaum Associates.

Clement, J. (1979). Patterns in Joey's comments on arithmetic problems. Journal of Mathematical Behavior, 2(2), 55-68.

Curricula

Ramirez, M., Nunez, M. and Clement, J. *Energy and the human body*, (a 350 p. middle school biology curriculum). Available at: http://www.cesd.umass.edu/energyinthehumanbody/ (acc. 2009)

Camp, C., Clement, J., Brown, D., Gonzalez, K., Kudukey, J. Minstrell, J., Schultz, K., Steinberg, M., Veneman, V., and Zietsman, A. (1994, 2nd Edition 2010). *Preconceptions in mechanics: Lessons dealing with conceptual difficulties* (a 380 p. high school physics curriculum guide). College Park, MD: American Assn. of Physics Teachers. Pre-publication version, ISBN: 978-1-931024-13-6

Papers in Conference Proceedings:

Stephens, L., & Clement, J. (2015). "Whole class vs. small group settings for using animations in physics: Case study comparisons," The Physics Education Research Conference Proceedings.

Stephens, L. & Clement, J. (2006). Depictive gestures as evidence for dynamic mental imagery in four types of student reasoning. Proceedings of the Physics Education Research Conference, Syracuse, New York, July 26-27, 2006.

Clement J. (2004). Imagistic processes in analogical reasoning: Conserving transformations and dual simulations. In Forbus, K., Gentner, D. and Regier, T., Editors, Proceedings of the Twenty-Sixth Annual Conference of the Cognitive Science Society, 26, 233-238. Mahwah, NJ: Erlbaum.

Clement J. (2003). Imagistic simulation in scientific model construction. In R. Alterman and D. Kirsh, Editors, Proceedings of the Twenty-Fifth Annual Conference of the Cognitive Science Society, 25, 258-263. Mahwah, NJ: Erlbaum.

Else, M., Clement, J. and Ramirez, M. (2003). Should different types of analogies be treated differently in instruction? Observations from a middle-school life science curriculum. Proceedings of the National Association for Research in Science Teaching, Philadelphia.

Clement J. (2002). Protocol evidence on thought experiments used by experts. In Wayne Gray and Christian Schunn, Eds., Proceedings of the Twenty-Fourth Annual Conference of the Cognitive Science Society. Mahwah, NJ: Erlbaum.

Clement, J. (2002). Managing student/teacher co- construction of visualizable models in large group discussion. Proceedings of the AETS 2002 Conference. In ERIC. http://files.eric.ed.gov/fulltext/ED465602.pdf

Else, M., Ramirez, M., and Clement, J. (2002). When are analogies the right tool? A look at the strategic use of analogies in teaching cellular respiration to middle-school students. Proceedings of the AETS 2002 Conference. In ERIC: http://files.eric.ed.gov/fulltext/ED465602.pdf

Nunez, M., Ramirez, M., Clement, J., Else, M. (2002). Teacher-student co-construction in middle school life science. Proceedings of the AETS 2002 Conference. In ERIC, https://files.eric.ed.gov/fulltext/ED465602.pdf

Ramirez, M. and Clement, J. (1997) Teaching for understanding , part I: Concepts of conceptual change and dissonance. In Proceedings of the International Conference "From Misconceptions to Constructed Understanding". Cornell University.

Monaghan, J. & Clement, J. (June 1997) Conceptual change in working physics classrooms. In Proceedings of the International Conference on "From Misconceptions to Constructed Understanding". Cornell University.

Clement, J. and Ramirez, M. (1997) Teaching for understanding, part II: Graphical representations of dissonance and conceptual change. In proceedings of The International Conference on "From Misconceptions to Constructed Understanding", Cornell University.

Ramirez, M. and Clement, J. (1997) Conceptual models of human respiration and misconceptions that present possible impediments to students' understanding. In Proceedings of the International Conference: From Misconceptions to Constructed Understanding. Cornell University.

Rea-Ramirez, M. A., & Clement, J. (1997). Developing a conceptual framework of students' understanding of human respiration. In R. Abrams (Ed.), Proceedings of the fourth International Misconceptions Seminar - From Misconceptions to Constructed Understanding. Santa Cruz, CA: The Meaningful Learning Research Group.

Steinberg, M. and Clement, J. (1997) Constructive model Evolution in the study of electric circuits. In Proceedings of the international Conference: From Misconceptions to Constructed Understanding. Cornell University.

Monaghan, J. & Clement, J. (1996) Collaborative problem solving with relativity simulations. In Educational Multimedia and Hypermedia 1996: Proceedings of ED_MEDIA 96. Charlottesville, VA: Association for the Advancement of Computing in Education.

Monaghan, J. & Clement, J. (1995). Use of collaborative computer simulation activities to facilitate relative motion learning. In Computer Support for Collaborative Learning '95, Bloomington, IN, Indiana University.

Clement, J. (1994). Imagistic simulation and physical intuition in expert problem solving. In Ram, A. and Eiselt, K. (Eds.) The Sixteenth Annual Meeting of the Cognitive Science Society, (pp. 201-206) Lawrence Erlbaum, Hillsdale, NJ.

Monaghan, J. and Clement J. (1994). Use of a computer simulation to assist students in learning relative motion concepts. Proceedings of the Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics. Ithaca, NY: Cornell University.

Zietsman, A. and Clement, J. (1994). Combining qualitative and quantitative research methods in tutoring experiments. Proceedings of the Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics. Ithaca, NY: Cornell University.

Clement, J. (1993). Model construction and criticism cycles in expert reasoning. In the Proceedings of the Fifteenth Annual Conference of the Cognitive Science Society. Hillsdale, NJ: Lawrence Erlbaum.

Clement, J., with the assistance of Brown, D., Camp, C., Kudukey, J., Minstrell, J., Palmer, D., Schultz, K., Shimabukuro, J., Steinberg, M., and Veneman, V. (1987). Overcoming students' misconceptions in physics: The role of anchoring intuitions and analogical validity. Novak, J. (Ed.), Proceedings of the 2nd International Seminar on Misconceptions and Educational Strategies in Science and Mathematics, Cornell University.

Schultz, K., Murray, T., Clement, J., and Brown, D. (1987). Overcoming misconceptions with a computer-based tutor. Novak, J. (Ed.), Proceedings of the 2nd International Seminar on Misconceptions and Educational Strategies in Science and Mathematics, Cornell University.

Clement, J. (1986). Methods used to evaluate the validity of hypothesized analogies. Proceedings of the Ninth Annual Meeting of the Cognitive Science Society. Hillsdale, NJ: Lawrence Erlbaum Associates.

Clement, J. (1986). Dealing with conceptual difficulties in mechanics: The use of analogies. Proceedings of the International Conference on Trends in Physics Education, Tokyo, Japan.

Clement, J. (1985). Misconceptions in graphing. Proceedings of the Ninth International Conference for the Psychology of Mathematics Education, The Netherlands.

Clement, J. (1984). Basic problem solving skills as prerequisites for advanced problem solving skills in mathematics and science. Proceedings of the Sixth Annual Meeting, International Group for the Psychology of Mathematics Education, North American Chapter. ERIC RIE #253-433.

Clement, J. (1983). Use of analogies and spatial transformations by experts in solving mathematics problems. Proceedings of the Fifth Annual Meeting of the International Group for the Psychology of Mathematics Education, North American Chapter, Montreal. ERIC RIE #ED-225-809.

Clement, J. (1982). Analogical reasoning patterns in expert problem solving. Proceedings of the Fourth Annual Meeting of the Cognitive Science Society, Ann Arbor.

Clement, J. (1981). Analogy generation in scientific problem solving. Proceedings of the Third Annual Meeting of the Cognitive Science Society, Berkeley, CA. ERIC RIE #SE-048-920.

Clement, J., Lochhead, J. and Soloway, E. (1980). Positive effects of computer programming on students' understanding of variables and equations. Proceedings of the Association for Computing Machinery National Conference, Nashville, TN.

Honors:

Outstanding Accomplishment in Research and Creative Activity Award, U. of Massachusetts, Amherst, 2007.

National Career Award: Distinguished Contributions to Science Education Through Research Award from the National Association for Research in Science Teaching, 2005.

Accomplishment Based Renewal Grant Award, National Science Foundation, 1995.

Graduate and Post-Doctoral Supervision:

Supervision of twelve completed doctoral theses. Ten of these students have gone on to become college faculty members, e.g. at the U. of Ill., Urbana and the U. of British Columbia, Vancouver; four were also post doctoral research associates under my supervision. Supervision of one additional post doctoral research associate as sponsor for her Spencer Fellowship Award.

Community Service: Companion in Big Brother Program, 1981 - 2000.