

**David Hammer**  
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## EDUCATION

Ph.D.            1991, University of California, Berkeley: Science and Mathematics Education  
M.A.            1987, University of California, Berkeley: Physics  
B.A.            1982, Princeton University: Physics (cum laude)

## EMPLOYMENT

2005 – present: Professor of Physics and Curriculum & Instruction, University of Maryland at College Park (UMCP)  
1998 – 2005: Associate Professor of Physics and Curriculum & Instruction, UMCP  
1998 – present: Coordinator of the Science Teaching Center, Department of Curriculum & Instruction, UMCP  
1992 – 1998: Assistant Professor of Education, Tufts University. Promoted to Associate Professor with tenure, 5/98.  
1991 – 1992: Lecturer (50%), Group in Science and Mathematics Education, University of California, Berkeley (UCB).  
1991 – 1992: Post-doctoral research associate (50%), for Dr. Andrea diSessa, Local Conceptual Change project, Group in Science and Mathematics Education, UCB.  
1988 – 1991: Research assistant (8/88 - 8/91), for Dr. Andrea diSessa, Boxer project, Group in Science and Mathematics Education, UCB  
11/1990: Visiting lecturer (November, 1990), at the Educational Research and Design Unit, RMIT Victoria University Institute of Technology in Melbourne, Australia.  
Summer 1988: Instructor, Physics Department, UCB  
1985 – 1987: Research assistant (7/85-6/87), Physics Department, UCB.  
1984 – 1988: Teaching Assistant (8/84 - 5/88) Physics Department, UCB  
1982 – 1984 High school teacher, Scarsdale Alternative School, Scarsdale Public Schools.  
Teaching credential (mathematics): Summer 1983, University of Massachusetts, Amherst Math / Science / Technology Education Project; Harvard University School of Education, Institute for Moral Education: Summer 1983.

## RESEARCH AND SCHOLARLY ACTIVITIES

### Books

Hammer, D. and van Zee, E. H. (2006). *Seeing the Science in Children's Thinking: Case Studies of Elementary Student Inquiry in Physical Science*. Portsmouth, NH: Heinemann. (with DVD).

### Book chapters

Elby, A, & Hammer, D. (in press). Epistemological resources and framing: A cognitive framework for helping teachers interpret and respond to their students' epistemologies. In

- L.D. Bendixon & F.C. Haerle (Eds.), *Personal Epistemology in Pre-K to 12 Education: Theory, Research, and Educational Implication*.
- Brown, D. E., & Hammer, D. (in press). Conceptual change in physics. In S. Vosniadou (Ed.), *International Handbook of Research on Conceptual Change*. New York: Routledge.
- Hammer, D., Russ, R., Mikeska, J., & Scherr, R. (in press). Identifying inquiry and conceptualizing students' abilities. In R. Duschl & R. Grandy (Eds.) *Teaching Scientific Inquiry: Recommendations for Research and Application*. Rotterdam, NL: Sense Publishing.
- Hammer, D., Elby, A., Scherr, R., & Redish, E. F. (2005). Resources, framing, and transfer. In J. P. Mestre (Ed) *Transfer of Learning from a Modern Multidisciplinary Perspective*. Greenwich, CT: IAP. (pp. 89-119)
- Hammer, D. (2004). The variability of student reasoning. In E. Redish & M. Vicentini (Eds.), *Proceedings of the Enrico Fermi Summer School, Course CLVI: Italian Physical Society*.  
Lecture 1: Case studies of children's inquiries. (pp. 279-299)  
Lecture 2: Transitions. (pp. 301-319)  
Lecture 3: Manifold cognitive resources. (pp. 321-340)
- DiSessa, A., Elby, A., & Hammer, D. (2002). J's epistemological stance and strategies, in G. Sinatra (ed.), *Intentional Conceptual Change*. (pp. 237-290). Mahwah, NJ: Erlbaum.
- Hammer, D. & Elby, A. (2002). On the form of personal epistemology. In B. K. Hofer & P. R. Pintrich (Eds.), *Personal Epistemology: The Psychology of Beliefs about Knowledge and Knowing*. (pp. 169-190). Mahway, NJ: Erlbaum.
- Hammer, D., (2000). Teacher inquiry. In Minstrell, J. and van Zee, E., (Eds.), *Teaching and Learning in an Inquiry-Based Science Classroom*. (pp. 184-215.) Washington DC.: American Association for the Advancement of Science.

### Articles in Refereed Journals

- Russ, R. S., Scherr, R. E., Hammer, D., & Mikeska, J. (in press). Recognizing mechanistic reasoning in student scientific inquiry: A framework for discourse analysis developed from philosophy of science. *Science Education*.
- May, D. B., Hammer, D., & Roy, P. (2006). Children's analogical reasoning in a third-grade science discussion. *Science Education*, **90**(2), 316-330.
- Rosenberg, S. A., Hammer, D., & Phelan, J. (2006). Multiple epistemological coherences in an eighth-grade discussion of the rock cycle. *Journal of the Learning Sciences*, **15**(2), 261-292.
- van Zee, E. H., Hammer, D., Bell, M., Roy, P., & Peter, J. (2005). Learning and teaching science as inquiry: A case study of elementary school teachers' investigations of light. *Science Education*, **89** (6), 1007-1042.
- Louca, L., Elby, A., Hammer, D, and Kagey, T. (2004). Epistemological resources and elementary school science education. *Educational Psychologist*, **39** (1), 57-68.
- Hammer, D. & Elby, A. (2003). Tapping students' epistemological resources. *Journal of the Learning Sciences*, **12** (1), 53-91.
- Hammer, D. & Schifter, D. (2001). Practices of inquiry in teaching and research. *Cognition and Instruction*, **19** (4), 441-478.
- Elby, A., & Hammer, D. (2001). On the substance of a sophisticated epistemology. *Science Education*, **85**(5), 554-567.
- Hammer, D. (2000). Student resources for learning introductory physics. *American Journal of Physics, Physics Education Research Supplement*, **68** (S1), S52-59.
- Hammer, D. (1997). Discovery learning and discovery teaching. *Cognition and Instruction*, **15** (4), 485-529.
- Hammer, D. (1996). Misconceptions or p-prims: How may alternative perspectives of cognitive structure influence instructional perceptions and intentions? *Journal of the Learning Sciences*, **5** (2), 97-127. (Also 1995, Education Development Center Center for the Development of Teaching Paper Series, Newton, MA.)

- Hammer, D. (1996). More than misconceptions: Multiple perspectives on student knowledge and reasoning, and an appropriate role for education research. *American Journal of Physics*, **64** (10), 1316-1325.
- Hammer, D. & DiMauro, V. (1996). Student teachers on LabNet: Linking preservice teachers with a professional community. *Electronic Journal of Science Education*, **1** (2), <http://nspweb.ed.unr.edu:443/hammer.htm>
- Hammer, D. (1995). Epistemological considerations in teaching introductory physics. *Science Education*, **79** (4), 393-413. (Also 1995, Education Development Center Center for the Development of Teaching Paper Series, Newton, MA)
- Hammer, D. (1995). Student inquiry in a physics class discussion. *Cognition and Instruction*, **13** (3), 401-430.
- Hammer, D. (1994). Students' beliefs about conceptual knowledge in introductory physics. *International Journal of Science Education*, **16** (4), 385-403.
- Hammer, D. (1994). Epistemological beliefs in introductory physics. *Cognition and Instruction*, **12** (2), 151-183.
- Sherin, B., diSessa, A., & Hammer, D. (1993). Dynaturtle revisited: Learning physics through collaborative design of a computer model. *Interactive Learning Environments*, **3** (2), p. 91-118.
- Metz, K., and Hammer, D. (1993). Learning physics in a computer microworld: In what sense a world? *Interactive Learning Environments*, **3** (1), 55-76.
- diSessa, A., Hammer, D., Sherin, B., & Kolpakowski, T. (1991). Inventing graphing: Meta-representational expertise in children. *Journal of Mathematical Behavior*, **10**, p. 117-160.
- Hammer, D. (1989). Two approaches to learning physics. *The Physics Teacher*, **27**, p. 664-671.

### **Monographs, Reports, and Extension Publications**

Physics Panel for the Committee on Programs for Advanced Study of Math & Science in American High Schools. (Spital, R., Chair; Gates, S.J.; Hammer, D.; Hilborn, R.C.; Mazur, E.; Moore, P.; Morse, R. A.), (2002) *Learning and Understanding: Improving Advanced Study of Mathematics and Science in U.S. High Schools: Report of the Content Panel for Physics*. National Academy Press.

### **Book Reviews, Other Articles, Notes**

- Hammer, D., & Coffey, J. (2005). What NASA has to offer. In G. Walker, E. Wahl & L. Rivas (Eds.), *NASA and Afterschool Programs: Connecting to the Future* (pp. 76-83). Washington, DC: NASA.
- Hammer, D. (2001). Powerful technology and powerful instruction. In T. Koschmann, R. Hall, & N. Miyake (Eds.), *CSCL2: Carrying Forward the Conversation* (pp. 399-403). Mahwah, NJ: Erlbaum. (Invited commentary.)
- Hammer, D. (1999). Physics for First-Graders? *Science Education*, **83** (6), 797-799.
- Hammer, D. & diSessa, A. (1990). Children are not abstractions. *The Physics Teacher*, **28**, p. 440.

### **Talks, Abstracts, and Other Professional Papers Presented**

#### Invited Talks, Seminars, and Colloquia

Attending and responding to students' epistemologies in physics instruction. Conference on Research in Undergraduate Mathematics Education, San Diego CA, February 29, 2008  
 What do the students need? North Carolina State University Physics Department Colloquium, January 14, 2008.

Accounting for variability in a teacher's epistemology: Epistemological resources and framing. TERC Brown Bag Seminar, Cambridge, MA. October 15, 2007. (with Andrew Elby)

Panelist: Exploring teaching assistant training programs. 2007 Summer Meeting of the American Association of Physics Teachers, Greensboro, NC. August 1, 2007.

The dynamics of coherence in conceptual understanding. 2007 Summer Meeting of the American Association of Physics Teachers, Greensboro, NC. July 31, 2007.

Student resources for learning science. Gordon Research Conference: Chemistry Education Research & Practice, Bates College, Lewiston ME, June 27, 2007.

The best note I ever got, University of Maine Center for Science and Mathematics Education Research, Summer workshop for math and science teachers, "Bringing Guided-Inquiry Curricula into Science and Mathematics Classrooms," June 25, 2007.

The goal of student inquiry, University of Maine Center for Science and Mathematics Education Research, Summer workshop for math and science teachers, "Bringing Guided-Inquiry Curricula into Science and Mathematics Classrooms" Conference, June 25, 2007.

Epistemological resources and epistemological framing. Leibniz-Institute for Science Education (IPN), Workshop of the DFG-Network on Epistemological Beliefs. Kiel, Germany, May 12, 2007.

What do the students need? How different theoretical stances may inform instructional diagnoses. University of Illinois at Urbana-Champaign, Physics Education Research Group, May 19, 2006.

Multiple modes of mind. Foundations and Frontiers in Physics Education Research, Bar Harbor ME, August 17, 2005.

Variability and local coherences of student inquiry in physics. Learning in Science Group Seminar, University of Cyprus, June 23, 2005.

Attending and responding to student thinking in a (challenging?) high school physics class. Math-Science Partnerships Workshop for Challenging Courses And Curricula, National Research Council, April 18, 2005.

Discovery learning and discovery teaching; Inquiry as its own agenda. Knowles Foundation Fellows Workshop, University of Maryland University College, April 7, 2005.

Identifying inquiry and conceptualizing students' abilities. Inquiry Conference on Developing a Consensus Research Agenda, New Brunswick, NJ. February 18, 2005

What is physics education research, who does it, and what does it offer? Rutgers University, Department of Physics and Astronomy Colloquium. February 9, 2005.

Variability and local coherences of K-16 student reasoning in physics. Seminar for the Center for Connected Learning and Computer-based Modeling, Department of Learning Sciences, Northwestern University. December 1, 2004.

What do the students need? Dickinson College Department of Physics and Astronomy Colloquium, November 15, 2004.

Variability and local coherences of K-16 student reasoning in physics. University of California, Berkeley, Education in Mathematics, Science, and Technology Colloquium. October 4, 2004.

What is physics education research and who does it? University of Maryland, Department of Physics Colloquium. September 14, 2004.

Resources, Framing, and Transfer, with A. Elby, R. Scherr, and E.F. Redish. 2004 Summer Meeting of the American Association of Physics Teachers.

Hearing the science in students' thinking. Planetary Astronomy Lunch Seminar, University of Maryland, College Park. May 5, 2004.

Discovery learning and discovery teaching. National Academy of Sciences Board on Science Education, Committee on High School Science Labs, March 29, 2004.

Inspirational closing remarks. Towson University, Department of Physics, Astronomy, and Geosciences. Scientific Inquiry Workshop, January 22, 2004.

Helping pre-service elementary teachers learn to attend to student thinking, with M. Lau. 2004 Winter Meeting of the American Association of Physics Teachers.

What do the students need? University of Maryland, Department of Physics Colloquium. September 22, 2003.

What do the students need? University of Colorado, Boulder, Department of Physics Colloquium. September 17, 2003.

Beyond misconceptions: Brown bag lunch discussion of student resources. University of Colorado, Boulder, Department of Physics. September 17, 2003.

Perspectives on elementary science teaching and teacher preparation. Physics Education Research Conference, August 7, 2003.

Thoughts on professional development and curriculum. Center for Curriculum Materials in Science, University of Michigan, Ann Arbor. June 18, 2003.

What prepares students to succeed in college physics? 2003 April Meeting of the American Physical Society, April 6, 2003.

Challenging Courses and Curricula (Plenary Panel). MSP Learning Network Conference, Washington DC. January 31, 2003.

Personal epistemologies and student participation. 2003 Winter Meeting of the American Association of Physics Teachers.

What do the students need? New York University, Department of Physics Colloquium. October 3, 2002.

Student resources for learning introductory physics. University of Maine, Department of Physics and Astronomy Colloquium. December 7, 2001.

Case studies of pre K-8 student inquiry in physical science, with E. H. van Zee. National Science Foundation, Directorate of Education and Human Welfare, Seminar, December 18, 2001.

What should we see in elementary student science inquiry? University of Maryland at College Park, Math and Science Education Seminar, November 2, 2001.

What should we see in elementary students' inquiry? 2001 Summer Meeting of the American Association of Physics Teachers.

The tension for a physics teacher between "promoting inquiry" and "covering content." Meeting of the National Science Teachers Association, Baltimore. November 17, 2000.

Preparing teachers as diagnosticians. 2000 Summer Meeting of the American Association of Physics Teachers.

Student resources for learning introductory physics. Ohio State University, Department of Physics, Physics Education Group Seminar. March 27, 2000.

Teacher inquiry and research on learning. University of Maryland at College Park, Mathematics Education Group lunch seminar. September 17, 1999.

Epistemological primitives, with A. Elby. University of Maryland at College Park, Physics Education Research Group Seminar. February 25, 1999

An ontology of (learners') epistemologies. University of Maryland at College Park, Department of Human Development, February 17, 1999.

Teacher inquiry and education research. Northwestern University, Department of Learning Sciences Colloquium, January 22, 1999.

A different introduction to physics. University of Maryland at College Park, Physics Education Research Group Seminar. October 8, 1998

An appropriate role for physics education research: Multiple perspectives on student knowledge and reasoning. University of Toronto, Department of Physics Colloquium, December 3, 1998.

More than misconceptions: What physics teachers may see in their students. University of New Hampshire, Durham NH, Fall Meeting of the New England Section of the American Physical Society. October 23, 1998.

Coordinating student inquiry and traditional content in high school physics. University of Maryland at College Park, Department of Curriculum and Instruction, March 31, 1998.

An appropriate role for physics education research: Multiple perspectives on students' knowledge and reasoning. University of Maryland at College Park, Department of Physics, March 30, 1998.

Panelist on the link between research and teaching. Spencer Foundation Doctoral Fellows Meeting, Harvard University, December 9, 1997.

The tension for a physics teacher between promoting "inquiry" and "covering content." Carnegie Mellon University, Center for Innovation in Learning Colloquium, November 21, 1997.

Research perspectives and teacher perceptions. University of Massachusetts, Amherst, Scientific Reasoning Research Institute Colloquium, April 29, 1997.

A new introductory course: "How to Learn Physics." 1997 Winter Meeting of the American Association of Physics Teachers.

Coordinating student inquiry and traditional content in a high school physics class. Center for the Development of Teaching Sandwich Seminar, Sept. 18, 1996.

An appropriate role for physics education research: Multiple perspectives on students' knowledge and reasoning. Dickinson College Summer Seminar, "Teaching Introductory Physics Using Interactive Teaching Methods and Computers." Invited talk and workshop, June 20-21, 1996.

An appropriate role for physics education research: Multiple perspectives on students' knowledge and reasoning. Tufts University Physics Department, March 29, 1996.

The contributions of education research to physics instruction. 1996 Winter Meeting of the American Association of Physics Teachers.

Student inquiry in a physics class. Tufts University Wright Center for Science Education, seminar Sept 23, 1993.

Student inquiry in a physics class. Bolt, Beranek, and Newman, seminar July 20, 1993.

Conceptual inquiry in a physics class. 1993 Summer Meeting of the American Association of Physics Teachers.

Conceptual inquiry in physics class discussions. Education Development Center, March 11, 1993.

Epistemological beliefs in introductory physics. San Diego State University, Center for Research in Science and Mathematics Education Colloquium, May 8, 1992.

Epistemological beliefs in introductory physics. University of California at Berkeley, SESAME/EMST Colloquium, March 16, 1992.

### Other Invited Conferences

Research Agenda in Science Education Conference, National Academies of Science, Washington DC, June 5-7, 2006

Transfer of Knowledge Workshop, National Science Foundation, Arlington, VA, March 21-22, 2002

Physiology Educational Research Consortium "Misconceptions" Meeting, Chicago, IL, June 22-23, 2001.

The Role of Students' Epistemologies in Learning with Models, Concord Consortium, Concord MA, June 8-9, 2001.

PhD in Physics Education Research, North Carolina State University, Sept. 30 - Oct. 1, 1994.

New Mechanics Conference, Tufts University August 6 - 8, 1992.

Carleton Conference of the Introductory University Physics Project August 18-20, 1988.

## Refereed Conferences

### *Published*

- Conlin, L.D., Gupta, A., Scherr, R.E., & Hammer, D. (2007). The dynamics of students' behaviors and reasoning during introductory physics tutorial sessions. *AIP Conference Proceedings*, V. 951. 69-72.
- Louca, L. & Hammer, D. (2007). Elementary students nascent abilities for scientific argumentation. In S. Vosniadou, D. Kayser, A. Protopapas (Eds). *Proceedings of the European Cognitive Science Conference, 2007*. London: Taylor and Francis.
- May, D. & Hammer, D. (2004). Elements of expertise in the use of analogies in a 3rd-grade science discussion. *Proceedings of the 2003 Physics Education Research Conference, PERC Publications*, Loudonville, NY, 2004.
- Louca, L., Druin, A., Hammer, D., & Dreher, D. (2003). Students' collaborative use of computer-based programming tools in science: A Descriptive Study. In B. Wasson, St. Ludvigsen, & Ul. Hoppe (Eds.). *Designing for Change in Networked Learning Environments: Proceedings of the International Conference on Computer Support for Collaborative Learning 2003 (CSCL)* (pp. 109-118) The Netherlands: Kluwer Academic Publishers.
- Louca, L., Hammer, D., & Bell, M. (2002). Developmental versus context-dependant accounts of abilities for scientific inquiry: A case study of 5-6th grade student inquiry from a discussion about a dropped pendulum. In P. Bell, R. Stevens & T. Satwicz (Eds.), *Keeping Learning Complex: The Proceedings of the Fifth International Conference of the Learning Sciences* (pp. 261-267). Mahwah, NJ: Erlbaum.
- Hammer, D. & Elby, A. (2000). Epistemological resources. In B. J. Fishman & S. F. O'Connor-Divelbiss (Eds.), *Proceedings of the International Conference of the Learning Sciences 2000, Ann Arbor MI.*(pp. 4-5). Mahwah, NJ: Erlbaum.

### *Unpublished*

- Elby, A., Lau, M., and Hammer, D. Accounting for Variability in a Teacher's Epistemology. 2007 Annual Meeting of the American Educational Research Association (AERA).
- Hutchison, P., Kulin, S., Allie, S., and Hammer, D. Scaffolding Scientific Reasoning and Argumentation. 2007 AERA.
- Coffey, J.E. Elby, A., and Hammer, D. Everyday Assessment: To What Do Teachers Pay Attention in the Science Classroom? 2007 AERA.
- Levin, D. M., Coffey, J.E., Hammer, D., Sanyal, A., Hopkins, N. Teacher Attention to Student Thinking: A Systems Perspective. 2007 AERA.
- Lau, M., Hammer, D., Elby, A., and Hovan, D., Framing as a Tool for Understanding Variability in Teacher Attention and Interaction. 2007 AERA.
- Sanyal, A., Levin, D., and Hammer, D. Views from the Ground: Looking Policy Through the Lens of Teacher Attention. 2007 AERA.
- Honda, S., Coffey, J.E., Grant, T., and Hammer, D. The Generative Nature of Teacher Attention to Student Thinking. 2007 AERA.
- Levin, D.M., Hammer, D, and Bybee, M., Redesigning Professional Development for Attention to Student Learning. 2007 AERA.
- Discussant for symposium, "Teaching and Learning Physical Science in Urban Secondary Schools: Assessing the Assessments." 2007 AERA.
- Chair for symposium, "Thinking Through Representations: A Knowledge-in-Pieces Epistemological Perspective." 2007 AERA.
- van Zee, E.H. and Hammer, D. Developing interpretations of video cases of student inquiry in physical science. 2006 Annual Meeting of the National Association for Research in Science Teaching (NARST).
- Discussant for symposium, "Why Complexity is Important for Learning." 2006 AERA.

Russ, R., Hammer, D., and Scherr, R.E. Identifying mechanistic reasoning in student inquiry. 2006 NARST.

Hodges, R. and Hammer, D. Using symbolic forms to detect meaningful use of equations. 2006 NARST.

Russ, R., Mikeska, J, Scherr, R. E., and Hammer, D. Recognizing and distinguishing scientific aspects of first graders' reasoning about motion. 2005 AERA.

May, D. and Hammer, D. Elements of expertise in the use of analogies in a 3<sup>rd</sup>-grade science discussion. 2005 AERA.

Hutchison, P. and Hammer, D. Epistemic roles for students and teachers in a "science as inquiry" classroom. 2005 AERA.

van Zee, E. H. and Hammer, D. Developing Interpretations of Student Inquiries in Physical Science. 2004 AERA.

Discussant for symposium, "Exploring Issues of Epistemology in Contemporary, Non-majority Communities of Practice." 2004 AERA.

Multiple local coherences in student epistemologies. 2004 AERA.

Epistemological resources. 2003 NARST.

Panelist for session, "'Personal Epistemology': Conflicts and Consensus in an Emerging Area of Inquiry." 2002 AERA.

Epistemological resources and contexts. 2002 AERA

Discussant for symposium, "Themes, controversies, and implications of studies relating to students' epistemologies in learning with scientific models." 2002 AERA.

Louca, L, Bell, M., and Hammer, D. Answers, explanations, and arguments in a 5-6th grade discussion about a dropped pendulum. 2002 AERA.

Preparing teachers as diagnosticians—the case of science. 2001 AERA.

Discussant for symposium, "Assessing and changing students' epistemological beliefs about science and learning." 1999 AERA.

Discussant for symposium, "Staging, sustaining, and establishing norms: Characterizing how science teachers facilitate inquiry." 1999 AERA.

Teacher inquiry and research on learning. 1999 AERA.

Analogies and student inquiry. 1999 AERA.

Discussant for symposium, "Getting Inside a Scientific Theory: Teacher Professional Development Through Inquiry." 1998 NARST.

Discussant for symposium, "Reforming University Science and Math Classes: Epistemological Challenges." 1998 AERA.

Student inquiry, traditional content, and the emergent curriculum of a high school physics class. 1997 AERA.

Discussant for symposium, "Investigating the relationship between students' epistemologies of science and their learning." 1997 AERA.

The influence of perspectives from education research on physics teachers' perceptions and intentions. 1996 AERA.

How alternative perspectives on cognitive structure influence physics teachers' perceptions and intentions. 1996 AERA.

Linking preservice teachers with a professional community, with V. DiMauro, 1996 AERA.

The practical significance of a perspective on students' epistemologies. 1995 AERA.

Epistemological considerations in teaching introductory physics. 1994 AERA.

Conceptual inquiry in a physics class. 1993 European Association for Research on Learning and Instruction (EARLI).

Chair and discussant of session "Meaningful science: New views for teachers and students." 1993 AERA.

Sherin, B., diSessa, A., and Hammer, D. Physics and the language of programming. 1992 AERA.

Metz, K. and Hammer, D. Problem solving in a computer microworld: Rhyme and reason in problem space shifts. 1992 AERA.

Talking physics: Conceptual inquiry in a class discussion. 1992 AERA.  
The role of metaknowledge in introductory physics. 1991 AERA.  
Students' beliefs about conceptual knowledge in introductory physics. 1991 EARLI.

### Unrefereed Conferences

- Gupta, A., Redish, E.F., and Hammer, D., Case studies in learners ontologies in physics. Contributed talk at the 2008 Winter Meeting of the American Association of Physics Teachers, Baltimore, MD.
- Scherr, R., Frank, B., and Hammer, D., Gestures as evidence of student meaning. Contributed talk at the 2008 Winter Meeting of the American Association of Physics Teachers, Baltimore, MD.
- Frank, B., Scherr, R., and Hammer, D., Integrating mathematical and physical reasoning: The role of mechanistic explanation relating undergraduate mathematics and physics education. Invited talk at the 2008 Winter Meeting of the American Association of Physics Teachers, Baltimore, MD.
- Scherr, R. and Hammer, D. Student behavior and epistemological framing: Examples from Tutorials. Invited talk at the 2008 Winter Meeting of the American Association of Physics Teachers, Baltimore, MD.
- Conlin, L, Gupta, A., Scherr, R., and Hammer, D., Framing and reasoning in tutorials over the course of a semester. Contributed poster at the 2008 Winter Meeting of the American Association of Physics Teachers, Baltimore, MD.
- Conlin, L.D., Gupta, A, Scherr, R.E., and Hammer, D., The Dynamics of students' behaviors and reasoning during collaborative physics tutorial sessions. Contributed poster at the 2007 Physics Education Research Conference, Greensboro, N.C.
- Goertzen, R.M, Hutchison, P., and Hammer, D. Priming epistemological framing in introductory physics students. Contributed poster at the 2007 Physics Education Research Conference, Greensboro, N.C.
- Gupta, A., Redish, E.F., and Hammer, D. Coordination of Mathematical and Physical Resources by Physics Graduate Students. Contributed poster at the 2007 Physics Education Research Conference, Greensboro, N.C.
- Redish, E.F., Gupta, A., and Hammer, D. A Dynamic Model of Expert and Novice Ontologies in Physics. Contributed poster at the 2007 Physics Education Research Conference, Greensboro, N.C.
- Conlin, L.D., Gupta, A, Scherr, R.E., and Hammer, D. Students' patterns of reasoning and behavior during physics tutorials. 2007 Summer AAPT.
- Frank, B. W., Scherr, R.E., and Hammer, D. Beyond confusion: Alternative accounts of students' failure to differentiate. 2007 Summer AAPT.
- Gupta, A, Redish, E.F, and Hammer, D. Student models of electric current: An ontological analysis. 2007 Summer AAPT.
- Redish, E.F., Gupta, A., and Hammer, D. Revisiting the ontological characterization of physics concepts. 2007 Summer AAPT.
- Van Zee, E. H. and Hammer, D. Interpreting Video Case Studies of Science Learning and Teaching. National Science Teachers Association, 2007
- Van Zee, E. H., Rosenberg, J., and Hammer, D. Using Video Case Studies of Student Inquiry in Physical Science. Annual Meeting of the Association for Science Teacher Education, Clearwater FL, January 6, 2007.
- Lau, M., Hammer, D., Elby A., and Hovan, D. Case for variability in teaching practice. 2006 Summer Meeting of the American Association of Physics Teachers (AAPT).
- Van Zee, E.H. and Hammer, D. Teacher thinking about elementary student thinking about motion. 2006 Winter AAPT.
- Scherr, R.E., Hammer, D. and Hodges, R. How do students frame tutorials? Foundations and Frontiers in Physics Education Research, Bar Harbor ME, August 15-19, 2005.

Russ, R., Scherr, R.E., and Hammer, D. Using a Mechanistic Framework to Identify Valuable Aspects of Incorrect Student Comments during Science Discussions. Foundations and Frontiers in Physics Education Research, Bar Harbor ME, August 15-19, 2005.

Hodges, R. and Hammer, D. The disconnect between physical sense and mathematics in upper level students. Foundations and Frontiers in Physics Education Research, Bar Harbor ME, August 15-19, 2005.

Hutchison, P. Kulin, S., and Hammer, D. Dialogues concerning two interpretations of inquiry. 2005 Summer AAPT.

Lau, M. and Hammer, D. Making sense of students' thinking: A case study of a pre-service elementary school teachers. 2004 Summer AAPT.

Redish, E.F., McCaskey, T., Elby, A., Hammer, D., and Lising, L. Epistemological gains in a large lecture class. 2003 Summer AAPT.

May, D. and Hammer, D. Spontaneous generation and use of analogies in an elementary science discussion. 2003 Summer AAPT.

Atkins, L., Hammer, D., and Hutchison, P. Functional vs. structural analogies: A conceptual or epistemological basis? 2003 Summer AAPT.

An epistemological intervention with big results, with R. Scherr. 2003 Summer AAPT.

Design implications of a resource-based perspective on student knowledge and reasoning, with E. F. Redish. 2003 Winter AAPT.

Lising, L. and Hammer, D. What contributes to shifts in elementary teacher practice? 2003 Winter AAPT.

Epistemological resources for learning introductory physics. 1999 Summer AAPT.

Teacher perceptions and researcher perspectives. 1998 Winter AAPT.

Snippets and perspectives: conversations among physics teachers. 1997 Winter AAPT.

Epistemological considerations in teaching introductory physics. 1995 Winter AAPT.

Students' beliefs about conceptual knowledge. 1992 Winter AAPT.

Sherin, B., Hammer, D., diSessa, A., Ploger, D., Adams, S., and Kolpakowski, T. Learning physics through programming. 1990 Summer AAPT.

Expert novices. 1990 Summer AAPT.

Kinematics for sixth graders: an application of a computational medium, with A. diSessa, D. Ploger, S. Adams, B. Sherin, and T. Kolpakowski, 1990 Winter AAPT.

Supporting unproductive approaches to learning physics. 1989 Summer AAPT.

## Workshops

The goal of student inquiry. Science Teachers Association of Ontario 2007 Conference, Toronto, November 16, 2007

Attending and responding to student thinking, University of Maine Center for Science and Mathematics Education Research, "Bringing Guided-Inquiry Curricula into Science and Mathematics Classrooms", June 25, 2007.

Workshop sessions on attending and responding to student inquiry, for the Teachers' Advanced Study Institute, NASA Goddard Space Flight Center, July 20-21, 2006.

Video Case Studies of Elementary Student Inquiry in Physical Science, with E. van Zee, M. Bell, J. Mikeska, J. Phelan, P. Roy, and K. Swire. Annual Meeting of the Association for Science Teacher Education, Portland, OR, January 13, 2006.

Workshop on inquiry teaching, with L. Lising, D. May, and L. Atkins, Montgomery County MSP Retreat, May 1, 2003.

Case studies of student inquiry, with others. Workshop for the Maryland Association of Science Teachers Conference, River Hill High School, Clarksville, MD, October 19, 2001.

What should we see in students' inquiry? Workshop at the University of Maryland-Prince George's County Professional Development School Mini-Conference, Eleanor Roosevelt High School, Greenbelt, MD, October 18, 2001.

Otero, V, Hammer, D, May, D, and Goldberg, F. How do we know what students are thinking? Workshop at the 2001 Summer Meeting of the American Association of Physics Teachers.  
Allen, S. and Hammer, D. Qualitative Video Analysis. Workshop at the 1991 Winter Meeting of the American Association of Physics Teachers.

## Contracts and Grants

Disciplinary Experts in Science Education Research: A University of Maryland Program for Producing STEM Education Researchers. (1/08-12/12), with A. Elby, *et al*, funded by the National Science Foundation (\$1.5 M). Principal Investigator.  
Learning Progressions for Scientific Inquiry: A Model Implementation in the Context of Energy (1/08-6/12), with Fred Goldberg (PI), Janet Coffey, *et al*, funded by the National Science Foundation (\$2.8M total, \$870K subcontract to UM), UM Principal Investigator.  
Collaborative Research: Open-source physics tutorial worksheets with faculty / TA development and implementation resources, (9/07-8/09), with Andy Elby, Rachel Scherr (PI), *et al*, funded by the National Science Foundation (\$300K). Co- Principal Investigator  
What influences teachers' modifications of curriculum? (6/05-5/08), with J. Coffey, A. Elby, and A. Berkowitz, funded by the National Science Foundation. (1.3 M). Principal Investigator.  
Toward a new conceptualization of what constitutes progress in learning physics, K-16. (4/05-4/08), with A. Elby, E. F. Redish, and R. Scherr, funded by the National Science Foundation. (\$800 K). Principal Investigator.  
Developing conceptual and teaching expertise in physics graduate students: An integrated approach. With R. E. Scherr (PI), A. Elby, and E.F. Redish funding by the National Science Foundation (\$210K). Co-Principal Investigator.  
Teaching middle school science as inquiry. (1/05-8/05), with Lubna Rana, funded by the NASA Goddard Director's Discretionary Fund (\$15K).  
Helping students learn how to learn: Open-source physics worksheets integrated with TA development resources (6/04-5/06), with A. Elby (PI), E. F. Redish, S. Rosenberg and S. Vokos, funded by the National Science Foundation (\$405K). Co-Principal Investigator.  
Learning How to Learn Science: Physics for Bioscience Majors (10/00 to 9/03), with E. F. Redish (PI), funded by the National Science Foundation (\$941K original funding, \$97K supplement awarded 6/04). Co-Principal Investigator.  
Case Studies of Elementary Student Inquiry in Physical Science (6/00 to 5/03), with E. H. van Zee, funded by the National Science Foundation (\$873K original funding, \$150K supplement awarded 1/02). Principal Investigator.  
Advancing Reforms in Science Education: Teachers' Conceptual Resources (8/96 to 6/99), funded by the MacArthur / Spencer Professional Development Research and Documentation Program (\$107K). Principal Investigator.  
Teachers' Resources Network in Physics (1/95 - 6/96), part of the Teachers' Resources Network at the Center for the Development of Teaching at the Education Development Center (\$50K subcontract), funding by the Dewitt-Wallace-Reader's Digest Fund. Principal Investigator at Tufts University on subcontract from EDC.

## Fellowships and Awards

Leo Schubert Award in College Teaching, 2007, Washington Academy of Sciences.  
National Academy of Education Spencer Fellowship, 1992-94. Project title: Educational theory as conceptual tool: Evaluating the perspective of *epistemological beliefs*.  
University of California Regents Graduate Fellowship 1988-89.

## **Editorial Boards & Reviewing Activities for Journals and Other Learned Publications**

### Editorships

2006 – present: Associate Editor, *Journal of the Learning Sciences*

### Editorial Review Boards

2001 – present: *Science Education*

2003 – 2007: *Journal of Research in Science Teaching*

2004 – 2006: *Journal of the Learning Sciences*

1999 – 2002: *Journal of Computers in Mathematics and Science Teaching*

1999 – 2004: *Physics Education Research Supplement/Section, American Journal of Physics*

### Ad Hoc Reviewing

*Cognition and Instruction*

*International Journal of Science Education*

*International Journal of Computers for Mathematical Learning*

*American Educational Research Journal*

*Reviews of Education Research*

*American Journal of Physics*

*Cognitive Science*

*Contemporary Educational Psychology*

*Journal of Teacher Education.*

John Wiley & Sons.

Laboratory at Brown University.

Center for Performance Assessment Paper Series at Educational Testing Service

Center for the Development of Teaching Paper Series at the Education Development Center.

Conferences: American Educational Research Association (conference paper proposals, for Division C, in science, mathematics and technology education; Division K, in teacher thinking and education, and the Special Interest Group in Science and Technology).

## **SERVICE**

### **Professional**

#### Offices and committee memberships held in professional organizations.

Advisor to planning committee, Physics Education Research Conference, Greensboro, N.C., August 1-2, 2007.

Planning committee for the NSTA/NRC “RAISE” conference, Research Agenda in Science Education; planning meeting at the National Research Council, Washington DC, March 10, 2006.

2005 American Educational Research Association program co-chair of Div K, Teaching and Teacher Education, section on science, mathematics, and technology.

2004 American Educational Research Association program co-chair of Div K, Teaching and Teacher Education, section on science, mathematics, and technology.

Chair of planning committee, Physics Education Research Conference, Trinity College, San Antonio, August 7-8, 1999.

1997 American Educational Research Association program co-chair of Div K, Teaching and Teacher Education, section on science, mathematics, and technology.

1994-1999, American Association of Physics Teachers, Committee on Education Research.

#### Reviewing activities for agencies

National Science Foundation Panel – REESE, 2/21-22/08.

Israel Science Foundation – ad hoc proposal reviewing, 3/2007.  
National Science Foundation Panel – Discovery Research K-12 (DRK-12), Component B, Resources and Tools, 12/6/06 and 12/13/06.  
National Science Foundation Panel – Math and Science Partnership Research and Technical Assistance (MSP-RETA), 6/26/06  
Site Visit Team for the National Science Foundation Science of Learning Centers, at the Center for Cognitive and Educational Neuroscience, Dartmouth College, 2/26 – 3/1/06.  
Spencer Foundation (assorted isolated proposals).  
National Research Council, Board on Testing and Assessment — “Systems for State Science Assessment,” 2005 Report of the Committee on Test Design for K-12 Science Achievement  
National Science Foundation Panel – Research on Learning and Education (ROLE), 1/03.  
National Science Foundation Panel – Centers for Learning and Teaching (CLT), 6/02.  
National Science Foundation Panel – Course, Curriculum and Laboratory Improvement (CCLI), 2/99.

### Other unpaid services to local, state, and federal agencies

Invited Guest of the Committee on Science Education K-12, National Academies Center for Education, Washington DC October 30–November 1, 2003.  
Physics Panel for NRC Committee on Programs for Advanced Study of Math & Science in American High Schools. 5/00 - 7/00). Reviewing AP and IB courses and examinations.  
Brief interview for the American Association for the Advancement of Science Update “Why is it?” Program. Aired on NPR November 7, 1996. (On why a hard-boiled egg is easier to spin than a raw egg!)

### Other committees, commissions, panels

Consultation visit (5/14/07), Westfälische Wilhelms-Universität, Münster, Germany, Department of Psychology, Rainer Bromme Research Team.  
Advisory board visit (6/21-28/05), University of Cyprus, Cyprus Research Foundation Project: Documenting the use of computer-based programming tools for developing models of physical and biological phenomena by fifth grade students  
National Research Council, Board on Science Education (8/2 and 9/2/04). Consulting on possible revision of National Science Education Standards.  
Advisory board member (10/02-9/05), *Conceptual Dynamics in Complex Science Interventions*. NSF CAREER award to Bruce Sherin.  
Advisory board member (7/02 – 6/05), *Curriculum Access System for Elementary Science*. NSF CAREER award to Elizabeth Davis.  
NASA Classroom of the Future project at Wheeling Jesuit College (2/13-16/97, 7/24-27/97). Advised on the assessment of *Astronomy Village: Investigating the Universe*.  
National Board for Professional Teaching Standards (3/6-7/98, 5/1-2/98). Participated in the design of "Assessment Center" exam prompts and evaluation criteria, to be part of the National Board's Adolescence and Young Adulthood/Science Assessment.  
Introductory University Physics Project (11/93 - 9/95). Advised on methods for analyzing data from student journals and interviews; reviewed drafts of publications.  
LabNet project at TERC (9/92 - 6/95). Contributed to discussions, by electronic mail and bulletin boards, within a national community of science and mathematics. Piloted use of LabNet in pre-service teacher education.