

Andrew F. Heckler

Department of Physics, Ohio State University
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Professional preparation

Ohio State University	Cosmology/Astrophysics	Post-doc 1996-99
Fermi National Accelerator Lab	Cosmology/Astrophysics	Post-doc 1994-96
University of Washington	Physics	Ph.D., 1994
Peace Corps, Gabon, Africa	H.S. Science Teacher	1986-88
Ohio State University	Physics	B.S., 1986

Appointments

Assistant Dean, College of Mathematical and Physical Sciences, Ohio State Univ. 1998-2005.
Assistant Professor, Department of Physics, Ohio State University. 2005-2011.
Associate Professor, Department of Physics, Ohio State University. 2011-present.

Grant Funding

Current:

“Center for Emergent Materials”, P.I.: N. Padture. Funded by NSF MRSEC program. I am a Senior Investigator, researching misconceptions in materials science as part of the education portion of the grant. Total budget of this NSF MRSEC center is \$11,000,000. The portion for my research is ~\$200,000. 9/1/2008-8/31/2014, \$11,000,000.

Previous:

“Scientific Misconceptions: From Cognitive Underpinnings to Educational Treatment”

PI: A. Heckler; Co-PI: V. Sloutsky. Funded by the Institute of Education Sciences, U.S. Department of Education. 9/1/2005-8/31/2010, \$933,397.

“Modeling instruction for Physical Science in Ohio”, PI: A. Heckler; Co-PI: K. Harper. Funded by Ohio Board of Regents Grant for Improving Teacher Quality. (2004-2006) \$114,790. Renewal: PI: K. Harper; Co PI: A. Heckler (2006-2009), \$363,756.

Publications in Peer-reviewed Journals

Education and Cognition Research

- 1) Rosenblatt, R., & Heckler, A. F. (2011). Systematic study of student understanding of the relationships between the directions of force, velocity, and acceleration in one dimension. *Physical Review Special Topics—Physics Education Research*, 7, 020112.
- 2) Scaife, T. M., & Heckler, A. F. (2011). Interference between electric and magnetic concepts in introductory physics, *Physical Review Special Topics—Physics Education Research*, 7, 010104.
- 3) Heckler, A. F., & E. C. Sayre (2010). What happens between pre- and post-tests: multiple measurements of student understanding during an introductory physics course, *American Journal of Physics*, 78, 768-777.
- 4) Scaife, T. M., & Heckler, A. F. (2010). Student understanding of the direction of the magnetic force on a charged particle, *American Journal of Physics*, 78, 869-876.
- 5) Heckler, A. F. (2010). Some consequences of prompting novice students to construct force diagrams, *International Journal of Science Education*, 32, 1829-1851.
- 6) Sayre, E. C., & Heckler, A. F. (2009). Peaks and decays of student knowledge in an introductory E&M course. *Physical Review Special Topics—Physics Education Research*, 5, 013101.
- 7) Kaminski, J. A., Sloutsky, V. M., & Heckler, A. F. (2009). Transfer of Mathematical Knowledge: The Portability of Generic Instantiations, *Child Development Perspectives*, 3, 151-155.
- 8) Kaminski, J. A., Sloutsky, V. M., & Heckler, A. F. (2009). Concrete Instantiations of Mathematics: A Double-Edged Sword, *Journal for Research in Mathematics Education*, 40, 90-93.

- 9) Kaminski, J. A., Sloutsky, V. M., & Heckler, A. F. (2008). The Advantage of Learning Abstract Examples in Learning Math. *Science*, 320, 454-455.
- 10) Sloutsky, V. M., Kaminski, J. A., & Heckler, A. F. (2005). The advantage of simple symbols for learning and transfer, *Psychonomic Bulletin & Review* 12 (3), 508-513.

Astrophysics and Cosmology

- 1) R. Lopez, S. Dodelson, A. F. Heckler, and M.S. Turner, Precision Detection of the Cosmic Neutrino Background, *Physical Review Letters* 82, 3952 (1999)
- 2) A. F. Heckler, Formation of a Hawking-radiation photosphere around microscopic black holes *Physical Review D* 55, 480 (1997)
- 3) A. F. Heckler, Calculation of the emergent spectrum and observation of primordial black holes *Physical Review Letters*, 78, 3430 (1997)
- 4) M. Gleiser, A. F. Heckler, and E.W. Kolb, "Modeling Thermal Fluctuations: Phase Mixing and Percolation", *Physics Letters B*, 405, 121 (1997)
- 5) M. Gleiser and A. F. Heckler, "Non-perturbative effects on nucleation", *Physical Review Letters* 76, 180 (1996)
- 6) A. F. Heckler and E.W. Kolb, Searching for stellar mass black holes in the solar neighborhood, *Astrophysical Journal Letters* 472, L85 (1996).
- 7) A. F. Heckler, The effects of electro-weak phase transition dynamics on baryogenesis and primordial nucleosynthesis, *Physical Review D* 51, 405 (1995).
- 8) A. F. Heckler, "Astrophysical applications of quantum corrections to the equation of state of a plasma", *Physical Review D* 49, 611 (1994).
- 9) A. F. Heckler and C.J. Hogan, "Neutrino heat conduction and inhomogeneities in the early universe", *Physical Review D* 47, 4256 (1993).

Book Chapters

- 1) Heckler, A. F. (2011). The Ubiquitous Patterns of Incorrect Answers to Science Questions: The Role of Automatic, Bottom-Up Processes. In J. P. Mestre and B. H. Ross (Eds.): *Psychology of Learning and Motivation: Cognition In Education*, Vol 55 (pp. 227-268), Oxford: Academic Press.

Publications in Peer-Reviewed Conference Proceedings

- 1) Heckler, A. F., & Rosenblatt, R. (2011). Student Difficulties with Basic Concepts in Introductory Materials Science Engineering. 41st ASEE/IEEE *Frontiers in Education Conference Proceedings*, S2H-1-6.
- 2) Rosenblatt, R., & Heckler, A. F. (2011). Group-Work Tutorials for an Introductory Materials Engineering Course. 41st ASEE/IEEE *Frontiers in Education Conference Proceedings*, S2H-7-12.
- 3) Heckler, A. F., Scaife, T. M., & Sayre, E. C. (2010). Response Times and Misconception-like Responses to Science Questions. In S. Ohlsson & R. Catrambone (Eds.), *Proceedings of the 32nd Annual Conference of the Cognitive Science Society* (pp. 139-144). Austin, TX: Cognitive Science Society.
- 4) Heckler, A. F. (2010). Concrete vs. Abstract Problem Formats: A Disadvantage of Prior Knowledge. *Learning in the Disciplines: Proceedings of the 9th International Conference of the Learning Sciences (ICLS 2010)*, Vol. 1, 365-371. International Society of the Learning Sciences: Chicago, IL.
- 5) Heckler, A. F., & Rosenblatt, R. (2010). Student Understanding of atomic bonds and their relation to mechanical properties of metals in an introductory materials science engineering course. *Proceedings of the Annual Conference of the American Society of Engineering Education*, Louisville, KY.
- 6) Rosenblatt, R., & Heckler, A. F. (2010). Student Understanding of the mechanical properties of metals in an introductory materials science engineering course. *Proceedings of the Annual Conference of the American Society of Engineering Education*, Louisville, KY.
- 7) Ding, L., Reay, N. W., Heckler, A. F., & Bao, L. (2010). Sustained Effects of Solving Conceptually Scaffolded Synthesis Problems, 133-136, *Proceedings of 2010 Physics Education Research Conference*. Melville, New York: AIP Conference Proceedings.

- 8) Rosenblatt, R., E.C. Sayre, & Heckler, A. F. (2009). Modeling students' conceptual understanding of force, velocity and acceleration. *Proceedings of 2009 Physics Education Research Conference*. Melville, New York: AIP Conference Proceedings.
- 9) Heckler, A. F., Kaminski, J. A., & Sloutsky, V. M. (2008). Learning Associations That Run Counter to Biases in Learning: Overcoming Overshadowing and Learned Inattention. *Proceedings of the XXX Annual Conference of the Cognitive Science Society*, 511-516. Austin, TX: Cognitive Science Society.
- 10) Kaminski, J. A., Heckler, A. F., & Sloutsky, V. M. (2008). Blocking effects on dimensions: How attentional focus on values can spill over to the dimension level. *Proceedings of the XXX Annual Conference of the Cognitive Science Society*, 1075-1080. Austin, TX: Cognitive Science Society.
- 11) E.C. Sayre, & Heckler, A. F. (2008). Evolution of student knowledge in a traditional introductory physics classroom. *Proceedings of 2008 Physics Education Research Conference*. Melville, New York: AIP Conference Proceedings.
- 12) Rosenblatt, R., E.C. Sayre, & Heckler, A. F. (2008). Toward a comprehensive picture of student understanding of force, velocity and acceleration. *Proceedings of 2008 Physics Education Research Conference*. Melville, New York: AIP Conference Proceedings.
- 13) Scaife, T. M., & Heckler, A. F. (2007). The Effect of Field Representation on Student Responses to Magnetic Field Questions. *Proceedings of 2007 Physics Education Research Conference*. Melville, New York: AIP Conference Proceedings.
- 14) Kaminski, J. A., Sloutsky, V. M. & Heckler, A. F., (2007). The Effects of Learning Multiple Instantiations on Transfer. *Proceedings of the XXIX Annual Conference of the Cognitive Science Society*, 1581-1585. Mahwah, NJ: Erlbaum.
- 15) Heckler, A. F., Kaminski, J. A., & Sloutsky, V. M. (2006). Differential Cue Salience, Blocking and Learned Inattention. *Proceedings of the XXVIII Annual Conference of the Cognitive Science Society*, 1167-1172. Mahwah, NJ: Erlbaum.
- 16) Kaminski, J. A., Sloutsky, V. M. & Heckler, A. F., (2006). Effects of Concreteness on Representation: An Explanation for Differential Transfer. *Proceedings of the XXVIII Annual Conference of the Cognitive Science Society*, 1167-1172. Mahwah, NJ: Erlbaum.
- 17) Kaminski, J. A., Sloutsky, V. M. & Heckler, A. F., (2006). Do Children Need Concrete Instantiations to Learn an Abstract Concept? *Proceedings of the XXVIII Annual Conference of the Cognitive Science Society*, 1167-1172. Mahwah, NJ: Erlbaum.
- 18) Kaminski, J. A., Sloutsky, V. M. & Heckler, A. F., (2005). Relevant concreteness and its effects on learning and transfer. *Proceedings of the XXVII Annual Conference of the Cognitive Science Society*, 1167-1172. Mahwah, NJ: Erlbaum.
- 19) Sloutsky, V. M., Kaminski, J. A., and Heckler, A. F. (2004) Transfer of learning between isomorphic artificial domains: Advantage for the abstract. *Proceedings of the XXVI Annual Conference of the Cognitive Science Society*, 1167-1172. Mahwah, NJ: Erlbaum.

Invited Presentations (Education and Cognition Research)

- 1) "The dynamics of learning and performance: student performance from milliseconds to months", Didactics Group Seminar, ETH Zurich, Switzerland July 2011.
- 2) "What causes the patterns in students' incorrect answers to physics questions?", Invited session, American Physical Society Conference, Garden Grove, CA. April 2011.
- 3) "What causes the patterns in students' incorrect answers to physics questions?" Physics Department Colloquium, University of Maine, April 2010.
- 4) "Implicit Learning and Learning Scientific Concepts", Invited Session, Winter Conference of the American Association of Physics Teachers, Washington DC. February 2010.
- 5) "Concrete vs. Abstract: is a little knowledge a bad thing?", Physics Department Colloquium, Indiana University-Purdue University Indianapolis, Oct 2009.
- 6) "What happens to student performance between the pre and post-test?" Invited Session, Summer Conference of the American Association of Physics Teachers, Ann Arbor, MI. July 2009.

- 7) "Understanding fundamental causes of student difficulties: Towards a first-principles design of instruction", Plenary Session, Frontiers and Foundations of Physics Education Research Biennial Conference, Bar Harbor, Maine, June 2009.
- 8) "Learning biases: Overcoming scientific misconceptions", Human Factors Interest Group seminar, University of Manchester, U.K. July 19, 2008.
- 9) "Overcoming Scientific Misconceptions", Kansas State University Physics Education Research Seminar. March 4, 2008.
- 10) "Current Research Projects", University of Washington Physics Education Research Seminar. Feb 5, 2008.
- 11) "Concrete vs. Abstract: Is a little knowledge a bad thing?" Invited Session, Physics Education Research Conference, Greensboro, NC, August 2007.
- 12) "Measuring understanding: dependence of student answering on the question task." Invited Session, Summer Conference of the American Association of Physics Teachers, Greensboro, NC. August 2007.
- 13) "Concrete vs. Abstract: Is a little knowledge a bad thing?", University of Illinois Champagne-Urbana Physics Education Research Seminar. April, 2007.
- 14) "Abstract or Concrete: Which is better for learning and transfer?", American Physical Society Conference, Invited session on Physics Education Research, Jacksonville, FL. April 2007.
- 15) "Abstract or Concrete, which is better for learning or transfer?" Invited Session, Summer Conference of the American Association of Physics Teachers, Syracuse, NY. August 2006.
- 16) "Abstract or Concrete, which is better for learning or transfer?" University of Maryland Physics Education Research Seminar. April, 2006.
- 17) "14) "Cognition and the Learning of Physics", Rutgers University Physics Education Research Seminar. May 4, 2005.
- 18) "Finding a Measure of Student Learning: the Normalized Gain and Other Measures", Ohio State University Physics Education Research Seminar. April 18, 2005.

Peer-Reviewed Conference Presentations

- 1) Response Times and Misconception-like Responses to Science Questions. Paper presented at 32nd Annual Conference of the Cognitive Science Society, Portland, OR, August 2010.
- 2) "Concrete vs. Abstract Problem Formats: A Disadvantage of Prior Knowledge." International Society of the Learning Sciences, International Conference, Chicago, IL, June 2010.
- 3) "Concrete vs. Abstract: is a little knowledge a bad thing?" National Association of Research in Science Teaching, 2009 National Conference, Garden Grove, CA, April 2009
- 4) Learning Associations That Run Counter to Biases in Learning: Overcoming Overshadowing and Learned Inattention. Paper presented at 30th Annual Conference of the Cognitive Science Society, Washington D.C., July 2008.
- 5) "How diagrams Help and Hinder Problem Solving", American Educational Research Association, 2007 National Conference, April 2007.
- 6) "The Role of Diagrams in Solving Problems", National Association of Research in Science Teaching, 2006 National Conference, San Fransisco, CA, April 2006.