

Andrew F. Heckler

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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. 2011-2017.
Professor, Department of Physics, Ohio State University. 2017-present.

Grant Funding

Current:

“STEM Fluency: Expanding the Effectiveness, Relevance, Equity, and Accessibility of Online Learning of Essential STEM Skills” PI: A. Heckler, Co-PI Don Walters 10/1/2023-9/30/2026, \$599,542.

“Constructing Valid, Equitable, and Flexible Kinematics and Dynamics Assessment Scales with Evidence-Centered Design” Collaborative Project: Lead PI (MSU): R. Henderson (\$240,000), WVU PI: J. Stewart (\$160,000), OSU PI: A. Heckler (\$196,959) 10/1/2023-9/30/2026

“QuSTEAM: Convergent undergraduate education in Quantum Science, Technology, Engineering, Arts, and Mathematics,” PI: E. Johnston-Halperin. Co-PI A. Heckler. NSF Accelerator Grant, 10/2021-8/2024 \$5M

Previous:

“Math Practice for Physics: Building Math Fluency in an Introductory Undergraduate Physics Context”, PI: A. Heckler, Co-PIs: B. Burrola Gabilondo, D. Meltzer. NSF IUSE award 10/2019-9/2023, \$473,281.

“NRT-IGE: Enhancing Learning and Retention in Graduate Physics”, PI: A. Heckler, Co-PI: C. Porter, J. Pelz, A. Kalish, C. Hirata. NSF NRT-IGE award 9/2017-8/2020, \$496,571.

“Center for Emergent Materials”, P.I.: C. Hammel. Funded by NSF MRSEC program. I am director of the Education and Human Resources Development, including a research program to improve learning in Materials-related topics. The portion for EHRD is approx. \$1.8M. 11/1/2014-8/31/2020, \$17,900,000.

“Investigating and Improving Synthesis Problem Solving Skills in Introductory Physics Via Analogical Reasoning”, PI: L. Ding, Co-PI: A. Heckler, R. Catrambone. NSF REESE award, 10/2013-9/2017, \$943,013

“Essentials Skills Practice for Introductory Physics Students”, PI: A. Heckler. OSU Office of Distance Education and eLearning Departmental Impact Grant, 1/1/2015-12/31/2016, \$22,500.

“GeoGames - online map games for teaching and learning through a real-world spatial perspective”, PI: O. Ahlqvist, Co-PI, A. Heckler, R. Ramnath. NSF Cyberlearning award, 10/2013-9/2015, \$459,154.

“Materials Science as content integrator in the Physical Science Classroom”, PI: G. Daehn, Co-PI: A. Heckler, I am a developer and facilitator of this teacher prof. dev. program. Ohio Dept of Education, 6/2013-6-2016, \$397,854.

“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.

Service

- 1) Chair line (vice, elect, chair, past) (elected position) Topical Group on Physics Education Research of the American Physical Society, 2018-2021.
- 2) Member, Education Policy Committee, appointed by American Physical Society’s Committee on Education, 2018-2021.
- 3) Research Fellow, Ohio State University Institute for Teaching and Learning, 2017-present.
- 4) Member (elected position), Executive Committee of the American Physical Society’s Forum on Education, 2015-2018.
- 5) Institute of Education Sciences (IES) proposal review panel member, 2008-2011, 2017-2018.
- 6) Chair, Board member OH-PKAL (Ohio Project Kaleidoscope regional network), 2015-2018.
- 7) College Board Advanced Placement Physics C Development Committee Member 2012-2017.
- 8) Editorial Board Member, Physics Review Special Topics: Physics Education Research. 2012-2015.
- 9) Chair, AAPT Research in Physics Education Committee. 2010-2011.
- 10) Natural Sciences Panel member, Ohio Board of Regents articulation and transfer program, 2005-present
- 11) Board Member, Communities in Schools of Central Ohio, 2005-2014.

Awards

- 1) Fellow of the American Physical Society, 2021
- 2) University Distinguished Teaching Award, Ohio State University, 2018
- 3) Outstanding Referee Award, American Physical Society, 2016
- 4) Outstanding Teaching Award, Physics Department, Ohio State University, 2016

Publications in Peer-reviewed Journals

Education and Cognition Research

- 1) Nieberding, M., & Heckler, A. F. (2023). Evolution of response time and accuracy on online mastery practice assignments for introductory physics students. *Physical Review Physics Education Research*, 19(2), 020111.
- 2) Suresh, S., & Heckler, A. F. (2023). Evolution of grades and social comparison concern within an introductory physics course. *Physical Review Physics Education Research*, 19(1), 010129.
- 3) Kryjevskaja, M., Heron, P.R.L., & Heckler, A.F. (2021). Intuitive or rational? Students and experts need to be both, *Physics Today* 74, 28-34.
- 4) Nieberding, M., & Heckler, A. F. (2021). Patterns in assignment submission times: Procrastination, gender, grades, and grade components. *Physical Review Physics Education Research*, 17(1), 013106.
- 5) Kim, Y., Yu, S. L., Koenka, A. C., Lee, H. W., & Heckler, A. F. (2021). Can self-efficacy and task values buffer perceived costs? Exploring introductory- and upper-level physics courses. *The Journal of Experimental Education*. Advance online publication.
- 6) Porter, C. D., & Heckler, A.F. (2020). Effectiveness of guided group work in graduate level quantum mechanics. *Physical Review Physics Education Research*, 16(2), 020127.
- 7) Simmons, A.B. & Heckler A.F. (2020). Grades, grade component weighting, and demographic disparities in introductory physics. *Physical Review Physics Education Research*, 16(2), 020125.

- 8) Porter, C. D., & Heckler, A.F. (2019). Graduate student misunderstandings of wave functions in an asymmetric well. *Physical Review Physics Education Research*, 15(1), 010139.
- 9) Heckler, A.F., & Bogdan, A.M. (2018). Reasoning with alternative explanations in physics: The cognitive accessibility rule. *Physical Review Physics Education Research*, 14(1), 010120.
- 10) Amos, N., & Heckler, A.F. (2018). Mediating relationship of differential products in understanding integration in introductory physics. *Physical Review Physics Education Research*, 14(1), 010105.
- 11) Young, N.T., & Heckler, A.F. (2018). Observed hierarchy of student proficiency with period, frequency, and angular frequency. *Physical Review Physics Education Research*, 14(1), 010104.
- 12) Ibrahim, B., Ding, L., Heckler, A.F., White, D.R., Badeau, R. (2017). How students process equations in solving quantitative synthesis problems? Role of mathematical complexity in students' mathematical performance. *Physical Review Physics Education Research*, 13(1), 020120.
- 13) Badeau, R., White, D.R., Ibrahim, B., Ding, L., Heckler, A.F. (2017). What works with worked examples: Extending self-explanation and analogical comparison to synthesis problems. *Physical Review Physics Education Research*, 13(2), 020112.
- 14) Ibrahim, B., Ding, L., Heckler, A.F., White, D.R., Badeau, R. (2017). Students' conceptual performance on synthesis physics problems with varying mathematical complexity. *Physical Review Physics Education Research*, 13(1), 010133.
- 15) Mikula, B. D., & Heckler, A. F. (2017). Framework and implementation for improving physics essential skills via computer-based practice: Vector math. *Physical Review Physics Education Research*, 13(1), 010122.
- 16) Heckler, A.F., & Mikula, B. D. (2016) Factors Affecting Learning of Vector Math from Computer-Based Practice: Feedback Complexity and Prior Knowledge. *Physical Review Physics Education Research*, 12, 010134.
- 17) Heckler, A. F., & Scaife, T. M. (2015) Patterns of Response Times and Response Choices to Science Questions: The Influence of Relative Processing Time. *Cognitive Science*, 39, 496-537.
- 18) Heckler, A. F., & Scaife, T. M. (2015). Adding and subtracting vectors: The problem with the arrow representation. *Physical Review Special Topics—Physics Education Research*, 11, 010101.
- 19) Kaminski, J. A., Sloutsky, V. M., & Heckler, A. F. (2013). The cost of concreteness: The effect of nonessential information on analogical transfer. *Journal of Experimental Psychology: Applied*, 19(1), 14-29.
- 20) Rosenblatt, R., Heckler, A. F., & Flores, K. (2013). A tutorial design process applied to an introductory materials engineering course. *Advances in Engineering Education*, 3(3-02), 1-38.
- 21) 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.
- 22) 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.
- 23) 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.
- 24) 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.
- 25) Heckler, A. F. (2010). Some consequences of prompting novice students to construct force diagrams, *International Journal of Science Education*, 32, 1829-1851.
- 26) 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.
- 27) 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.
- 28) 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.

- 29) Kaminski, J. A., Sloutsky, V. M., & Heckler, A. F. (2008). The Advantage of Learning Abstract Examples in Learning Math. *Science*, 320, 454-455.
- 30) 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) Halasek, K., Heckler, A.F., Rhodes-DiSalvo, M. (2020). Transforming the Teaching of Thousands: Promoting Evidence-based Practices at Scale. In *Transforming Institutions: Accelerating Systemic Change in Higher Education*. White, K., Beach, A., Finkelstein, N., Henderson, C., Simkins, S., Slakey, L., Stains, M., Weaver, G., & Whitehead, L. (Eds.). Pressbooks.
- 2) 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. and Porter, C.D. (2022) Graduate student understanding of quantum mechanical spin, 2022 PERC Proceedings [Grand Rapids, MI, July 13-14, 2022], edited by B. W. Frank, D. L. Jones, and Q. X. Ryan, doi:10.1119/perc.2022.pr.Heckler.
- 2) Rosenblatt, R. and Heckler, A. F. (2017). The Development Process for a New Materials Science Conceptual Evaluation, *2017 IEEE Frontiers in Education Conference (FIE)*, Indianapolis, IN, 2017, pp. 1-9, doi: 10.1109/FIE.2017.8190456.
- 3) Porter, C. D., Bogdan, A. M., and Heckler, A. F. (2017), Prelecture Questions and Conceptual Testing in Undergraduate Condensed Matter Courses, 2017 PERC Proceedings [Cincinnati, OH, July 26-27, 2017], edited by L. Ding, A. Traxler, and Y. Cao, doi:10.1119/perc.2017.pr.075.
- 4) Koenka, A. C., Yu, S. L., Kim, Y., Lafranconi, H., & Heckler, A. F. (2017, April). What predicts success in undergraduate physics? The importance of belonging and the complexity of cost. Paper presented at the Annual Meeting of the American Educational Research Association. San Antonio, Texas.
- 5) Porter, C. D., Bogdan, A. M., and Heckler, A. F. (2016), Student understanding of potential, wavefunctions and the Jacobian in hydrogen in graduate-level quantum mechanics, *2016 PERC Proceedings* [Sacramento, CA, July 20-21, 2016], edited by D. L. Jones, L. Ding, and A. Traxler, doi:10.1119/perc.2016.pr.056.

- 6) Ibrahim, B., Ding, L., White, D. R., Badeau, R., and Heckler, A. F. (2016), Synthesis problems: role of mathematical complexity in students' problem solving strategies, *2016 PERC Proceedings* [Sacramento, CA, July 20-21, 2016], edited by D. L. Jones, L. Ding, and A. Traxler, doi:10.1119/perc.2016.pr.037.
- 7) Amos, N.R. and Heckler, A. F. (2015), Student Understanding of Differentials in Introductory Physics, *2015 PERC Proceedings* [College Park, MD, July 30-31, 2015], edited by A. D. Churukian, D. L. Jones and L. Ding.
- 8) Badeau, R., White, D. R., Ibrahim, B., Heckler, A. F. and Ding, L. (2015), Applying Analogical Reasoning to Introductory-level synthesis problems, *2015 PERC Proceedings* [College Park, MD, July 30-31, 2015], edited by A. D. Churukian, D. L. Jones and L. Ding.
- 9) White, D. R., Badeau, R., Heckler, A. F. and Ding, L. (2014), Bottlenecks In Solving Synthesis Problems, *2014 PERC Proceedings* [Minneapolis, MS, July 30-31, 2014], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- 10) Badeau, R. and Heckler, A. F. (2014), Design and Evaluation of a Natural Language Tutor for Force and Motion, *2014 PERC Proceedings* [Minneapolis, MS, July 30-31, 2014], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- 11) Amos, N.R. and Heckler, A. F. (2014), Spatial Reasoning Ability And The Construction Of Integrals In Physics, *2014 PERC Proceedings* [Minneapolis, MS, July 30-31, 2014], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- 12) Bogdan, A. M. and Heckler, A. F. (2013), Effects of Belief Bias on Student Reasoning from Data Tables, *2013 PERC Proceedings* [Portland, OR, July 17-18, 2013], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- 13) Mikula, B. D. and Heckler, A. F. (2013), Student Difficulties with Trigonometric Vector Components Persist in Multiple Student Populations, *2013 PERC Proceedings* [Portland, OR, July 17-18, 2013], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- 14) White, D. R. and Heckler, A. F. (2013). Effects of Training Examples on Student Understanding of Force and Motion, *2013 PERC Proceedings* [Portland, OR, July 17-18, 2013], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- 15) Heckler, A. F., Mikula, B., & Rosenblatt, R. (2013). Student accuracy in reading logarithmic plots: the problem and how to fix it. *2013 IEEE Frontiers in Education Conference Proceedings*, 1066-1071.
- 16) Mikula, B. D., & Heckler, A. F. (2013). The effectiveness of brief, spaced practice on student difficulties with basic and essential engineering skills. *2013 IEEE Frontiers in Education Conference Proceedings*, 1059-1065.
- 17) Scaife, T. M., & Heckler, A. F. (2012). The Dependence of Instructional Outcomes on Individual Differences: An Example from DC Circuits. *Proceedings of 2012 Physics Education Research Conference*. Melville, New York: AIP Conference Proceedings.
- 18) 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.
- 19) Rosenblatt, R., Heckler, A. F., & Flores, K. (2011). Group-Work Tutorials for an Introductory Materials Engineering Course. *41st ASEE/IEEE Frontiers in Education Conference Proceedings*, S2H-7-12.
- 20) 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.
- 21) 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.

- 22) 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.
- 23) 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.
- 24) 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.
- 25) 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.
- 26) 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.
- 27) 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.
- 28) 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.
- 29) 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.
- 30) 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.
- 31) 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.
- 32) 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.
- 33) 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.
- 34) 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.
- 35) 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.
- 36) 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 and Peer-reviewed Presentations (Education and Cognition Research)

- 1) "Education Research's future: Examples of a model and method", Keynote 6th International Conference on Mathematics and Science Education, Malang East Java (Virtual), August 2022.

- 2) "Fairness, Equity, and Values in STEM Grades and Grading", Physics Colloquium, Kenyon College, April 2022.
- 3) "Two elephants in the room: traditional testing and curving", PER seminar, University of Illinois Urbana Champaign, (Virtual) May 2021.
- 4) "Fairness, Equity, and Values in Grades and Grading", Invited Keynote AAPT Western PA Annual meeting (Virtual), April 2021.
- 5) "Fairness, Equity, and Values in Grades and Grading", Physics Department Colloquium, Ohio State University, January 2021.
- 6) "Dual process model of reasoning: Navigating a Terrain" Invited Session, Winter Conference of the American Association of Physics Teachers. January 2021.
- 7) "Consistency and Fairness in Introductory Physics Course Grades" Invited Session, Winter Conference of the American Association of Physics Teachers. January 2021.
- 8) "What do grades tell us about students, instructors, and programs?" PER Seminar, University of Washington Bothell, December 2020
- 9) "Consistency and Fairness in Introductory Physics Course Grades" PER Seminar, University of Colorado Boulder, November 2020
- 10) "What do grades tell us about students, instructors, and programs?" Invited Session, Summer Conference of the American Association of Physics Teachers, July 2020.
- 11) "Highlights from studies on student learning, reasoning, and understanding in Physics", Physics Department Colloquium, Ohio University, September 2019.
- 12) "Building up to complexity: Synthesizing multiple concepts to solve problems", Invited Session, Annual Physics Education Research Conference, Provo UT, July 2019.
- 13) "Why is scientific reasoning so hard, and what can we do about it?" Invited Session, American Physical Society April Meeting, Denver, CO. April 2019.
- 14) "What basic skills should introductory physics students have?", Invited Session, Winter Conference of the American Association of Physics Teachers, Houston, TX. January 2019.
- 15) "Improving Fluency in STEM Essential Skills through Brief, Spaced Practice", AAC&U 2018 Transforming STEM Higher Education Conference, Atlanta GA. November 2018.
- 16) "Why is scientific reasoning so hard, and what can we do about it?" Conference at the Interface of Discipline-Based Education Research in STEM and Psychological Science Washington University, St. Louis, MO. September 2018.
- 17) "Is practicing Essential Skills Essential?", Invited Session, Winter Conference of the American Association of Physics Teachers, San Diego, CA. January 2018.
- 18) "Why is scientific reasoning so hard, and what can we do about it?" Physics Department Colloquium, University of Washington, November 2017.
- 19) "Improving STEM Essential Skills through Brief, Spaced Practice", Lilly Conference, Miami University, November 2017.
- 20) "The cognitive contours that influence science reasoning, and how to navigate them", PER Seminar, Purdue University, September 2017.
- 21) "Dear Common Sense: Can we talk? I am trying to learning science", Invited Conference talk, Research in Science Education Annual Conference, University of Maine, June 2016.
- 22) "A great method for creating questions for class, homeworks, and tests: Dissecting science concepts into dimensions." Invited Workshop, Research in Science Education Annual Conference, University of Maine, June 2016.
- 23) "Improving learning in an Introductory Materials Science Engineering Course", Invited Conference Talk, Materials Week, Ohio State University, May, 2016.
- 24) "Improving STEM instruction: Examples of how Discipline-Based Education Research can help" Invited Keynote for Workshop: Developing and Sharing Best Practices: From Concept to Classroom, American Society for Biochemistry and Molecular Biology. Otterbein University, February 2016.
- 25) "Measuring physics understanding on times scales from milliseconds to months", Invited Conference Talk, APS Mid-Atlantic Section Meeting, Morgantown, WV, October 2015.

- 26) "Are spatial diagrams best for STEM tasks involving spatial reasoning?" Invited Conference talk, Integrating Cognitive Science with Innovative Teaching in STEM Disciplines: Spatial Learning in STEM, Northwestern University. September, 2015.
- 27) "The contours that influence physics reasoning", Invited Session, Summer Conference of the American Association of Physics Teachers, Baltimore, MD. July 2015.
- 28) "Measuring physics understanding on times scales from milliseconds to months", PER Seminar, Michigan State University, April 2015.
- 29) "Improving skills through brief, spaced practice", The 6th North American Materials Education Symposium, 2015 Columbus, OH, March 2015.
- 30) "The contours that influence reasoning", PER Seminar, Stanford University, February 2015.
- 31) "The contours that influence reasoning", Invited Session, Winter Conference of the American Association of Physics Teachers, San Diego, CA. January 2015.
- 32) "Measuring physics understanding on times scales from milliseconds to months", PER Seminar, Purdue University, April 2014.
- 33) "Which is better: fast and "thoughtless", or slow and reasoned?", PER Seminar, Illinois State University, April 2014.
- 34) "The study of student responses to questions: assumptions and inferences" Invited Session, Winter Conference of the American Association of Physics Teachers, New Orleans, LA. January 2013.
- 35) "Which is better: fast and "thoughtless", or slow and reasoned?", Research in Science Education Annual Conference, invited talk, University of Maine, June 2012.
- 36) "A method for constructing good questions for use in class, homework and tests: the dissection of a scientific concept into its relevant and irrelevant dimensions" Research in Science Education Bi-Annual Conference, Invited workshop, June 2012.
- 37) "Measuring Physics Learning on Times Scales from Milliseconds to Months", Physics Department Colloquium, Ohio State University, November 2011.
- 38) "The dynamics of learning and performance: student performance from milliseconds to months", Didactics Group Seminar, ETH Zurich, Switzerland July 2011.
- 39) "What causes the patterns in students' incorrect answers to physics questions?", Invited session, American Physical Society Conference, Garden Grove, CA. April 2011.
- 40) "Response Times and Misconception-like Responses to Science Questions". Paper presented at 32nd Annual Conference of the Cognitive Science Society, Portland, OR, August 2010.
- 41) "Concrete vs. Abstract Problem Formats: A Disadvantage of Prior Knowledge." International Society of the Learning Sciences, International Conference, Chicago, IL, June 2010.
- 42) "What causes the patterns in students' incorrect answers to physics questions?" Physics Department Colloquium, University of Maine, April 2010.
- 43) "Implicit Learning and Learning Scientific Concepts", Invited Session, Winter Conference of the American Association of Physics Teachers, Washington DC. February 2010.
- 44) "Concrete vs. Abstract: is a little knowledge a bad thing?", Physics Department Colloquium, Indiana University-Purdue University Indianapolis, Oct 2009.
- 45) "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.
- 46) "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.
- 47) "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
- 48) "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.
- 49) "Learning biases: Overcoming scientific misconceptions", Human Factors Interest Group seminar, University of Manchester, U.K. July 19, 2008.

- 50) "Overcoming Scientific Misconceptions", Kansas State University Physics Education Research Seminar. March 4, 2008.
- 51) "Current Research Projects", University of Washington Physics Education Research Seminar. Feb 5, 2008.
- 52) "Concrete vs. Abstract: Is a little knowledge a bad thing?" Invited Session, Physics Education Research Conference, Greensboro, NC, August 2007.
- 53) "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.
- 54) "Concrete vs. Abstract: Is a little knowledge a bad thing?", University of Illinois Champagne-Urbana Physics Education Research Seminar. April, 2007.
- 55) "Abstract or Concrete: Which is better for learning and transfer?", American Physical Society Conference, Invited session on Physics Education Research, Jacksonville, FL. April 2007.
- 56) "How diagrams Help and Hinder Problem Solving", American Educational Research Association, 2007 National Conference, April 2007.
- 57) "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.
- 58) "The Role of Diagrams in Solving Problems", National Association of Research in Science Teaching, 2006 National Conference, San Francisco, CA, April 2006.
- 59) "Abstract or Concrete, which is better for learning or transfer?" University of Maryland Physics Education Research Seminar. April, 2006.
- 60) 14) "Cognition and the Learning of Physics", Rutgers University Physics Education Research Seminar. May 2005.
- 61) "Finding a Measure of Student Learning: the Normalized Gain and Other Measures", Ohio State University Physics Education Research Seminar. April 2005.