Maine Physical Sciences Partnership Publications (2009–2018)

Akiha, K., Brigham, E., Couch, B., Lewin, J., Stains, M., Stetzer, M., … Smith, M. (2018). What Types of Instructional Shifts Do Students Experience? Investigating Active Learning in Science, Technology, Engineering, and Math Classes across Key Transition Points from Middle School to the University Level, *Frontiers in Education, 2*. https://doi.org/10.3389/feduc.2017.00068

Alvarado, C. (2015). Ambientes de aprendizaje en Física: Evolución hacia ambientes constructivistas (Physics Learning Environments: Evolution towards constructivist environments). *Latin American Journal of Physics Education*, Vol. 9, SI July pp. SI1202.

Alvarado, C., Wittmann, M. C., Rogers, A. Z., & Millay, L. (2016). Problematizing " cold " with K12 science teachers. In *PERC* (pp. 32–35). https://doi.org/10.1119/perc.2016.pr.003

Avargil, S., Bruce, M. R. M., Amar, F. G. and Bruce, A. E. (2015). Students' Understanding of Analogy after a CORE (Chemical Observations, Representations, Experimentation) Learning Cycle, General Chemistry Experiment. *Journal of Chemical Education*, 92, 1626-1638.

Avargil, S., Bruce, M. R. M., Amar, F. G. and Shemwell, J. T. (2013). Model-based analogies for learning chemistry. *2013 NARST Annual International Conference: The S in STEM Education: Policy, Research and Practice*. Wyndham Rio Mar, Rio Grande, Puerto Rico.

Avargil, S., Shemwell, J. T., Capps, D. K., and Zoellick, B. (2013). Teacher's experiences with reform-based instructional resources: Coming to terms with new priorities for science learning. *2013 NARST Annual International Conference: The S in STEM Education: Policy, Research and Practice*. Wyndham Rio Mar, Rio Grande, Puerto Rico.

Axthelm, A., Wittmann, M.C., Alvarado, C. & Millay, L. (2015) Idea Use curves. In *Physics Education Research Conference (PERC)*.

Barth-Cohen, L., Capps, D. K., and Shemwell, J. T. (2014). Modeling the construction of evidence through prior knowledge and observations from the real world. Proceedings of the 11th International Conference of the Learning Sciences, Boulder.

Barth-Cohen, L., Smith. M. K., Capps D., Lewin, D. L.,Shemwell, J. T., & Stetzer. M. (2016). What are middle school students talking about during clicker questions? Characterizing small-group conversations mediated by classroom response systems. *Journal of Science Education and Technology*, (10.1007/s10956-015-9576-2), 1-12.

Barth-Cohen, L., Shemwell, J. T., and Capps, D. K. (2013). Using the knowledge in pieces framework to understand teachers' productive knowledge in field. *Geological Society of America*, Abstracts with Program, vol. 45, n. 7.

Barth-Cohen, L. Shemwell, J. & Capps, D., (2015). The Process of Generating an Argument at a Mechanistic Knowledge Level. Paper presented at the 2nd International Argument-Based Inquiry Conference 2015, Spokane, WA.

Barth-Cohen, L. Shemwell, J. & Capps, D., (2015). The Importance of Evidence Construction in Argumentation. Paper presented at the 2nd International Argument-Based Inquiry Conference 2015, Spokane, WA.

Barth-Cohen, L. & Wittmann, M. C. (2015). Mismatches between Represented Science Content and Unmet Expectations as a Mechanism of Model Revision. *National Association of Research in Science Teaching*.

Barth-Cohen, L. A., & Wittmann, M. C. (2016). Expanding Coordination Class Theory to Capture Conceptual Learning in a Classroom Environment. In *International Society of the Learning Sciences*.

Barth-Cohen, L. A., & Wittmann, M. C. (2017). Aligning Coordination Class Theory with a New Context: Applying a Theory of Individual Learning to Group Learning. *Science Education*.

Batz, Z. (2014). Reaching Struggling Introductory Biology Students with a Targeted Peer Tutoring Program, unpublished MST thesis, University of Maine. Advisor: Michelle Smith.

Bruce, M., Avargil, S., Amar, F. G., Shemwell, J. T., and Bruce, A. (2013). Using Laboratory Centered Analogies to Enhance Student Understanding of Chemical Concepts at the Molecular Level. *2013 NARST The S in STEM Education: Policy, Research, and Practice*. Wyndham Rio Mar, Rio Grande, Puerto Rico.

Bruce, M. R. M., Bruce, A. E., Avargil, S., Ois, F., Amar, G., Wemyss, T. M., and Flood, V. J. (2016).

Polymers and Cross-Linking: A CORE Experiment To Help Students Think on the Submicroscopic Level. *Journal of Chemical Education*. http://doi.org/10.1021/acs.jchemed.6b00010

Bruce, M. R. M., Wilson, T. A., Bruce, A. E., Bessey, S. M., and Flood, V. J. (2016). A Simple, Student-Built Spectrometer To Explore Infrared Radiation and Greenhouse Gases. *Journal of Chemical Education*, (2), acs.jchemed.6b00047. http://doi.org/10.1021/acs.jchemed.6b00047

Bruce, M. R., Wilson, T. A., Bruce, A. E., Bessey, S. M., & Flood, V. J. (2016). Infrared Radiation and Greenhouse Gases. *Journal of Chemical Education*, *93*(11), 1908–1915. https://doi.org/DOI:10.1021/acs.jchemed.6b00047

Capps, D. K., Avargil, S., Shemwell, J. T., Mason, T., Stetzer, M. R., and Smith, M. K. (2013). Reflecting on contrasts: Productive reflection by a pre-service teacher inspired by multiple field placements. *2013 NARST Annual International Conference: The S in STEM Education: Policy, Research and Practice*. Wyndham Rio Mar, Rio Grande, Puerto Rico.

Capps, D. K., Shemwell, J. T., Barth-Cohen, L., and Avargil, S. (2014). From using models to developing models: Professional development that pushes on teacher thinking. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Pittsburgh, PA.

Capps, D. K., Shemwell, J. T., Hoover, S., and Barth-Cohen, L. (2013). Using the scientific practice of modeling to support teachers in reasoning analogically and generalizing. *Geological Society of America*, Abstracts with Program, vol. 45, n. 7.

Dounas-Frazer, D. R., Van De Bogart, K. L., Stetzer, M. R., and Lewandowski, H. J. (2016). Investigating the role of model-based reasoning while troubleshooting an electric circuit. *Physical Review, Physics Education Research.* http://doi.org/10.1103/PhysRevPhysEducRes.12.010137

Dumont, J. (2015). Analysis of Struggling Student Performance in Response to Academic Intervention, unpublished MST thesis, University of Maine. Advisor: Michelle Smith.

Ferm, W. N. (2017). *Examining Student Ability to Follow and Interact with Qualitative Inferential Reasoning Chains*. University of Maine.

Ferm, W. N., Speirs, J. C., Stetzer, M. R., & Lindsey, B. A. (2016). Investigating student ability to follow and interact with reasoning chains III . In *PERC* (pp. 120–123). https://doi.org/10.1119/perc.2016.pr.025

Frank, B. W., Goertzen, R. M., and Hutchison, P. (2013). The pedagogical value of obvious questions in introductory physics. *The Physics Teacher*, 51, 487.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Wenderoth, M. P., Okoroafor, N., and Jordt, H. (2014). End of lecture: Active learning increases student performance across STEM disciplines. *PNAS*; published ahead of print May 12, 2014, doi:10.1073/pnas.1319030111.

Harrer, B. (2013). "Identifying Productive Resources in Secondary School Students' Discourse About Energy," Ph.D. dissertation, University of Maine. Co-Advisors: Michael C. Wittmann and Rachel E. Scherr. To be published open-access on ProCite.

Harrer, B. W., Scherr, R. E., Wittmann, M. C., Close, H. G., and Frank, B. W. (2012). Elements of Proximal Formative Assessment in Learners' Discourse About Energy. In C. Singh, M. Sabella, and P. Engelhardt (Eds.), *AIP Conference Proceedings, Volume 1413, 2011 Physics Education Research Conference* (pp. 203-206). Melville, NY: AIP.

Harrer, B. W., Flood, V. J., and Wittmann, M. C. (2013). Productive resources in students' ideas about energy: An alternative analysis of Watts' original interview transcripts. *Physical Review Special Topics - Physics Education Research*, 9, 023101.

Heck, D., & Minner, D. (2009). *Codebook for standards of evidence for empirical research.* Chapel Hill, NC: Horizon Research, Inc.

Inverness Research. (2016). *Maine Physical Sciences Partnership: Contributions to Students and Teachers*.

Ishimoto, M., Davenport, G., & Wittmann, M. C. (2017). Use of item response curves of the Force and Motion Conceptual Evaluation to compare Japanese and American students ' views on force and motion. *Physical Review Physics Education Research*, *20135*(13), 1–15. https://doi.org/10.1103/PhysRevPhysEducRes.13.020135

Knight, J. K., Wood, W. B., and Smith, M. K. (2013) What's downstream? A set of classroom exercises to help students understand recessive epistasis. *Journal of Microbiology and Biology Education*. 14(2).

Kranich, G. (2016). Inconsistent Conceptions of Acceleration Contributing to Formative Assessment Limitations, unpublished MST thesis, University of Maine. Advisor: Michael C. Wittmann.

Kranich, G., Wittmann, M.C., & Alvarado, C. (2015*)* Teachers' conflicting conceptual models and the efficacy of formative assessments. In *Physics Education Research Conference (PERC)*.

Kryjevskaia, M., and Stetzer, M.R. (2013). Examining inconsistencies in student reasoning approaches, *AIP Conf. Proc. 1513*, 226.

Kryjevskaia, M., Stetzer, M. R., and Heron, P. R. L. (2013). Student difficulties measuring distance in terms of wavelength: Lack of basic skills or failure to transfer? *Physical Review Special Topics - Physics Education Research*. 9 (1).

Kryjevskaia, M., Stetzer, M. R., and Heron, P. R. L. (2013). Is a simple measurement task a roadblock to student understanding of wave phenomena? *The Physics Teacher*, 51 , 560.

Kryjevskaia, M., Stetzer, M. R., & Le, T. K. (2014). Failure to Engage : Examining the Impact of Metacognitive Interventions on Persistent Intuitive Reasoning Approaches. In *AIP Conf. Proc.*

Laverty, D. (2016). Investigating Teachers' Content Knowledge and Pedagogical Content Knowledge in a Middle School Physical Science Curriculum on Force and Motion, unpublished MST thesis, University of Maine. Advisors: John R. Thompson and MacKenzie R. Stetzer.

Le, T. K. (2017). *Using Contrasting Cases to Build Metacognitive Knowledge About the Impact of Salient Distracting Features in Physics Problems*. University of Maine.

Le, T., Shemwell, J. T., Capps, D. K., Kirn, S., and Voyer, C. (2014). Obstacles and supports for effective reasoning with evidence in authentic science investigations. Paper presented at the annual

Lewin, J. (2016). A campus-wide investigation of University-level science, technology, engineering, and mathematics instruction: the status of clicker use and peer discussion, unpublished MST thesis, University of Maine. Advisors: Michelle Smith and MacKenzie Stetzer.

Lewin, J. D., Vinson, E. L., Stetzer, M. K. R., and Smith, M. K. (2016). A campus-wide investigation of clicker implementation: The status of peer discussion in STEM classes. *CBE Life Sciences Education*, *15*(1), 1–12. http://doi.org/10.1187/cbe.15-10-0224

Lucy, L. (2013). Correlations Between Students' Performance on Assessments and Teachers' Knowledge of Students and Energy, unpublished MST thesis, University of Maine. Advisor: Michael C. Wittmann.

Martin, R. (2016) Discussion in Middle and High School Earth Science Classrooms and its Impact on Students' Abilities to Construct Evidence-Based Arguments in their Written Work, unpublished MST thesis, University of Maine. Advisor: Susan R. McKay.

McDermott, L. C., Shaffer, P. S., Heron, P. R. L., Stetzer, M. R., and Messina, D. L. (2015). Preparing teachers to teach physics and physical science effectively through a process of inquiry. In E. Brewe and C. Sandifer (Eds.), *Effective Practices in Preservice Physics Teacher Education*. American Physical Society.

McKay, S., Millay, L., Allison, E., ByersSmall, E., Wittmann, M. C., Flores, M., … Smith, M. K. (2018). Investing in Teachers' Leadership Capacity: A Model from STEM Education. *Maine Policy Review*, *27*(1).

Michaud, K. and Capps, D. K., (2014). Using self-determination theory to understand students' experiences at an informal science learning center. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Pittsburgh, PA.

Nissen, J. M., Stetzer, M. R., & Shemwell, J. T. (2013). The experience sampling method: Investigating students' affective experience. In *AIP Conference Proceedings* (Vol. 1513, pp. 294–297). http://doi.org/10.1063/1.4789710

Papanikolaou, C. P., Tombras, G. S., Van De Bogart, K. L., and Stetzer, M. R. (2015). Investigating student understanding of operational-amplifier circuits. *American Journal of Physics*, *83*(12), 1039–1050. http://doi.org/10.1119/1.4934600

Pelletreau, K. N., Andrews, T., Armstrong, N., Bedell, M. A., Dastoor, F., Dean, N., … Smith, M. K. (2016). A clicker-based case study that untangles student thinking about the processes in the central dogma. *CourseSource*.

Scherr, R. E., Close, H. G., Close, E. W., Flood,V. J., McKagan, S. B., Robertson, A. D., Seeley, L., Wittmann, M. C., and Vokos, S. (2013). Understanding energy with a social embodied learning activity. *Physical Review Special Topics - Physics Education Research*, 9(2), 020105.

Shemwell, J. T., Avargil, S. A. & Capps, D. K. (2015). Grappling with long-term learning in science: A qualitative study of teachers' views of developmentally oriented instruction. *Journal of research in Science Teaching, 52*(8), 1163-1187

Shemwell, J. T., Gwarjanski, K. R., Capps, D. K., Avargil, S., & Meyer, J. L. (2015). Supporting Teachers to Attend to Generalisation in Science Classroom Argumentation. *International Journal of Science Education*, *37*(4), 599–628. http://doi.org/10.1080/09500693.2014.1000428

Shemwell. J.T., Capps, D.K., Gibson, D. (2014). From contrasting cases to contrasting models: Supporting generalization in model development. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Pittsburgh, PA.

Smith, M. K. and Merrill, S. (2014). Why do some people inherit a predisposition to cancer? A small group activity on cancer genetics. Course Source. In press.

Smith, M.K., Annis, S.L., Kaplan, J.J., and Drummond, F. (2012). Using peer discussion facilitated by clicker questions in an informal education setting: enhancing farmer learning of science. *PLOS-ONE*. 7 (10).

Smith, M. K., Jones, F. H. M., Gilbert, S. L., and Wieman, C. The Classroom Observation Protocol for Undergraduate STEM (COPUS): A new instrument to characterize university STEM classroom practices. CBE-Life Sci Educ. 2013, Winter, 12(4):618-627. This paper was selected as an Editor's Choice in Science.

Smith, M. K., Thomas, K., and Dunham, M. (2012). In-class incentives that encourage students to take concepts assessments seriously. *Journal of College Science Teaching*. 42 (2), 57-61.

Smith, M. K., Vinson, E. L., Smith, J. a., Lewin, J. D., & Stetzer, M. R. (2014). A Campus-Wide Study of STEM Courses: New Perspectives on Teaching Practices and Perceptions. *Cell Biology Education*, *13*(4), 624–635. http://doi.org/10.1187/cbe.14-06-0108

Smith, M. K., Wenderoth, M. P., Tyler, M. (2013). The teaching demonstration: what faculty expect and how to prepare for this aspect of the job interview. *CBE - Life Sciences Education*. 12 (1), 12-18.

Smith, M. K. (2012) A fishy way to discuss multiple genes affecting the same trait. *PLOS Biology*. Published, 10.1371/journal.pbio.1001279

Smith, M. K., Jones, F. H. M, Gilbert, S. L., and Wieman, C. E. (2013). The Classroom Observation Protocol for Undergraduate STEM (COPUS): A New Instrument to Characterize University STEM Classroom Practices. CBE Life Sci Educ vol. 12 no. 4 618-627.

Speirs, J. C., Ferm, W. N., Stetzer, M. R., & Lindsey, B. A. (2016). Probing student ability to construct reasoning chains : a new methodology. In *PERC* (pp. 328–331). https://doi.org/10.1119/perc.2016.pr.077

Stetzer, M., van Kampen, P., Shaffer, P. S., and McDermott, L. C. (2013). New insights into student understanding of complete circuits and the conservation of current. *American Journal of Physics*. 81 (2), 134-143.

Stevens, J., Barth-Cohen, L., Capps, D.K., (2014). Capturing teachers engagement with scientific modeling. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Pittsburgh, PA.

Thompson, J.R., Christensen, W.M., and Wittmann, M.C. Preparing future teachers to anticipate student difficulties in physics in a graduate-level course in physics, pedagogy, and education research. *Physical Review Special Topics - Physics Education Research*, p. 010108, vol. 7, (2011).

Trenckmann, E. (2017). *Development of an Active-Learning Lesson that Targets Student Understanding of Population Growth in Ecology*. University of Maine.

Trenckmann, E., Smith, M. K., Pelletreau, K. N., & Summers, M. M. (2017). An active-learning lesson that targets student understanding of population growth in ecology. *CourseSource*.

Maine Physical Sciences Partnership Publications (2009–2018)

Van De Bogart, K. L. Van De. (2017). *Investigating Student Learning of Analog Electronics*. University of Maine.

VanDeBogart, K. L., & Stetzer, M. R. (2014). Student Understanding of Circuit Loading in Physics and Engineering. In *Physics Education Research Conference (PERC)*.

VanDeBogart, K. L., & Stetzer, M. R. (2016). Investigating Physics and Engineering Students ' Understanding of AC Bias- ing Networks. In *American Society for Engineering Education*.

Van der Eb, M. (2016). Evaluation of the Collaborative Design Process and Classroom Implementation of a Place-Relevant Lesson in Ninth Grade Earth Science Classrooms, unpublished MST thesis, University of Maine. Advisor: Susan R. McKay.

Wilson, C.M. (2016). Science Teachers' Means of Engaging with Scientific Practices in High Quality Professional Development, unpublished undergraduate honors thesis, University of Maine. Advisor: Lauren Barth-Cohen.

Wittmann, M.C., Alvarado, C., Millay, L. (2015) Teacher responses to their multiple goals for teaching energy. In *Physics Education Research Conference (PERC)*.

Wittmann, M. C., Alvarado, C., & Millay, L. (2016). Teachers ' explanations of student difficulties with gravitational potential energy, 396–399. https://doi.org/10.1119/perc.2016.pr.094

Wittmann, M. C., Alvarado, C., & Millay, L. A. (2017). Teacher awareness of problematic facets of meaningful metaphors of energy. *Latin American Journal of Physics Education*.

Wittmann, M. C., and Black, K. E. (2014). Visualizing changes in pretest and post-test student responses with consistency plots. *Physical Review Special Topics - Physics Education Research*, *10*(1), 1–12. http://doi.org/10.1103/PhysRevSTPER.10.010114

Wittmann, M.C. and Black, K.E. (2015). Mathematical actions as procedural resources: An example from the separation of variables. *Physical Review Special Topics - Physics Education Research*, 11, 020114. doi:10.1103/PhysRevSTPER.11.020114

Young, A. M., Capps, D. K., and Mason, C. A. (2013). Teacher's understanding of inquiry and use of scientific practices: A survey of NSTA conference attendees. *2013 NARST Annual International Conference: The S in STEM Education: Policy, Research and Practice*. Wyndham Rio Mar, Rio Grande, Puerto Rico.

Zoellick, B. (2013). Use of Social Network Analysis to Study Expansion of a Community of Teachers: A Case Study of Issues and Methods. Presented at the NARST Annual International Conference, Rio Grande, Puerto Rico, April 6-9, 2013.

Zoellick, B. (2014). Emergence of Teacher Sub-communities and Focus on Science Subject Knowledge. Paper presented at the annual NARST conference, Pittsburgh, PA, March 30 – April 2, 2014.

Zoellick, B. (2015). Teacher Community Structure and Rural Science Education Reform. Presented at the NARST Annual International Conference, Chicago, IL, April 11-14, 2015.

Zoellick, B., Shemwell, J.T., Capps, D.K., and Avargil, S. (2013). Use of social network analysis to study teacher communities in design-based implementation research. *2013 NARST Annual International Conference: The S in STEM Education: Policy, Research and Practice*. Wyndham Rio Mar, Rio Grande, Puerto Rico.

Maine Elementary Sciences Partnership

Zoellick, B., & Millay, L. (2016). *Maine Elementary Sciences Partnership: Final Year Evaluation and Overall Reflection*. Retrieved from https://www.researchgate.net/publication/311371140_Maine_Elementary_Sciences_Partnership–Final_Year_Evaluation_and_Overall_Reflection