

RACHEL E. SCHERR

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EDUCATION

University of Washington

Seattle, Washington

Ph.D., Physics, 2001.

Dissertation: An investigation of student understanding of basic concepts in special relativity

Supervisors: Professor Lillian C. McDermott and Professor Stamatis Vokos

M.S., Physics, 1996.

Reed College

Portland, Oregon

B.A., Physics, 1993.

APPOINTMENTS

University of Washington, LIFE Center

Seattle, Washington

Visiting Scholar, October 2008 – present.

FACET Innovations

Seattle, Washington

Consultant, November 2008 – present.

University of Colorado

Boulder, Colorado

Evaluator, November 2008 – present.

University of Maryland, Department of Physics

College Park, Maryland

Research Assistant Professor, Physics Education Research Group, July 2004 – present.

Postdoctoral Research Associate, Physics Education Research Group, June 2001 – June 2004.

The Evergreen State College

Olympia, Washington

Visiting faculty, September 2000 – June 2001.

University of Washington

Seattle, Washington

Research Assistant, Physics Education Group, December 1996 – September 2000.

RESEARCH EXPERIENCE

Harvard University

Cambridge, Massachusetts

Co-principal investigator, “Technological and educational foundations for understanding and improving large-classroom learning” (NSF IIS 0835394), 2009-2011.

Conduct qualitative research of teacher practice of formative assessment in order to elucidate components of and obstacles to effective practice. Investigate the evolution of teachers’ establishment of a diagnostic learning environment in the science classroom.

FACET Innovations

Seattle, Washington

Consultant, “Honing diagnostic practice: Toward a new model of teacher professional preparation and development” (NSF DRL 0822342), 2008-2012.

Conduct qualitative research of teacher practice of formative assessment in order to elucidate components of and obstacles to effective practice. Investigate the evolution of teachers’ establishment of a diagnostic learning environment in the science classroom.

University of Colorado

Boulder, Colorado

Evaluator, “Towards a Center for STEM Education,” (NSF DRL 0833364), 2008-2011.

Identify appropriate evaluation metrics, supervise data collection, and report yearly on the establishment of a center whose purpose is to transform undergraduate STEM classes, support discipline-based education research, and recruit and prepare K-12 teachers.

University of Maryland, Department of Physics**College Park, Maryland**

Principal investigator, "Open-source physics tutorial worksheets with faculty/TA development and implementation resources" (NSF CCLI 0715567), 2007-2009.

Develop open-source, modifiable physics tutorials focused on both conceptual and epistemological development, linked to annotated video clips of students working on the tutorials in small groups.

Principal investigator, "Developing conceptual and teaching expertise in physics graduate students: An integrated approach" (NSF REC 0529482), 2006-2009.

Conduct basic research into the teaching practices and epistemologies of physics graduate teaching assistants in collaborative active-learning instructional environments. Develop in-depth case studies of TAs to understand what they understand about their role in facilitating student learning. Design professional development to promote sophisticated teaching practices and learning theories.

Project director and co-principal investigator, "Toward a new conceptualization of what constitutes progress in learning physics, K-16: Resources, frames, and networks" (NSF REC 0440113), 2005-08.

Re-conceptualize what is important for productive scientific thinking based on video case studies, construction of cognitive models, and development and application of a theoretically-grounded, empirically supported organizing framework. Identify the knowledge and abilities that children may learn in early science that can provide the foundation for success in college physics.

Co-principal investigator, "Helping students learn how to learn: Open-source physics worksheets integrated with TA development resources" (NSF CCLI 0341447), 2004-2007.

Develop open-source, modifiable physics tutorials focused on both conceptual and epistemological development, linked to annotated video clips of students working on the tutorials in small groups.

Senior personnel, "Learning How to Learn Science: Physics for Bioscience Majors" (NSF REC 0087519), 2001-2005.

Study college physics students' attitudes, expectations, and epistemologies and demonstrate that they can improve in a large course. Modify existing best-practice materials for introductory university physics to promote epistemological as well as conceptual development.

Senior personnel, "Case Studies of Elementary Student Inquiry in Physical Science" (NSF ESI 9986846), 2004-2005.

Develop a volume of written and video case studies as material to promote teachers' substantive investigation of student inquiry in physics. Cases include the transcript, video, and/or student written work, the author's reflections on his or her perceptions and judgments as the teacher, and insights and ideas gained from discussing the material with other teachers and researchers.

University of Washington, Department of Physics**Seattle, Washington**

Research assistant, "A new model for physics education in physics departments: Improving the teaching of physics from elementary through graduate school" (NSF DUE 9354501), 1996-2001.

Direct and conduct investigations of student understanding of topics in physics. Develop curriculum to address specific student difficulties. Design and perform studies to assess the effectiveness of these materials with university students. Develop and lead workshops on inquiry-based teaching materials for physics graduate students, university faculty members, and K-12 teachers.

TEACHING EXPERIENCE**University of Maryland, Department of Physics****College Park, Maryland**

Laboratory and tutorial instructor, Fundamentals of Physics (PHYS 121-122), Fall 2006-Spring 2007; co-instructor, Fall 2002-Spring 2006.

Supervise the laboratory/tutorial portion of a two-semester course in general physics treating the fields of mechanics, heat, sound, electricity, magnetism, optics, and modern physics. Conduct professional development for graduate teaching assistants who are the direct instructors.

Instructor, Graduate seminar in teaching physics, Fall 2006-2007; co-instructor, Fall 2001-2003.

Lead a weekly seminar designed to support and improve the teaching done by graduate teaching assistants in the physics department. Required for all departmental TAs in their first year.

Instructor, Special Problems in Advanced Physics: Physics Education Research for University Teaching (PHYS 798T), Spring 2004.

Teach a course designed to give graduate students in physics education research skills both for conducting research on the teaching and learning of physics and for applying the results of such research to classroom teaching. Topics include qualitative research methods (video and transcript analysis), quantitative research methods, and curriculum development and evaluation.

Instructor, Seminar in Teaching College Physics (PHYS 708), Fall 2002 and 2003.

Lead weekly seminar in current topics in physics education research.

The Evergreen State College

Olympia, Washington

Visiting faculty, 2000-2001.

Team-teach full-time interdisciplinary programs that include physics, education research, and other subjects including substantial composition experience. Modify research-based physics instructional materials for use with liberal arts students.

University of Washington, Department of Physics

Seattle, Washington

Lead teaching assistant for Department of Physics, 1998-2000.

Assist in leading weekly graduate teaching seminar for first-year graduate students, post-docs, and undergraduates. Assist faculty in administration of introductory calculus-based course. Assist in departmental and university-wide orientation programs for new TAs.

Head teaching assistant, 1995-2000.

Instruct in tutorial sections, traditional laboratories, and physics study center. Develop, modify, and assess instructional materials used in tutorials and lectures. Write exam questions and direct homework and examination grading. Supervise teaching assistants in tutorial sections.

Instructor, NSF Summer Institute for K-12 Teachers in Physics and Physical Science, 1995-1999.

Instruct in laboratory-based course to prepare K-12 teachers to teach physics and physical science using the *Physics by Inquiry* curriculum, as part of a team of instructors.

Reed College, Department of Physics

Portland, Oregon

Lab instructor, September 1992 - May 1993.

Assist with first implementation of *Real Time Physics* in introductory laboratories. Instruct in both traditional and modified laboratories. Modify traditional lab manual.

The Exploratorium

San Francisco, California

Explainer, Summer 1988 and 1989; Machine shop assistant, Summer 1990.

Oversee activity on the exhibit floor. Serve as a guide and facilitator, initiating contact with visitors to enrich the museum experience. Perform scientific demonstrations and engage visitors in exhibits.

PUBLICATIONS

1. R. M. Goertzen, R. E. Scherr, and A. Elby, "Tutorial TAs in the classroom: Framing teaching as a focus on indicators," in preparation to be submitted to *Phys. Rev. – Special Topics: Phys. Educ. Res.* (2009)
2. R. M. Goertzen, R. E. Scherr, and A. Elby, "Accounting for tutorial teaching assistants' buy-in to reform instruction," submitted to *Phys. Rev. – Special Topics: Phys. Educ. Res.* (2009)
3. R. E. Scherr, "Video analysis: Insight and coding," accepted to *Phys. Rev. – Special Topics: Phys. Educ. Res.* (2009)
4. R. E. Scherr and D. Hammer, "Student behavior and epistemological framing: Examples from collaborative active-learning activities in physics," *Cog. & Instr.* 27(2), 147–174 (2009)

5. D. Hammer, R. S. Russ, R. E. Scherr, and J. Mikeska, "Identifying inquiry and conceptualizing students' abilities," in R. Duschl and R. Grandy (Eds.), *Establishing a consensus agenda for K-12 science inquiry* (Sense Publishers, Rotterdam, NL) (in press)
6. R. M. Goertzen, R. E. Scherr, and A. Elby, "Indicators of understanding: What TAs listen for in student responses," in C. Henderson, M. Sabella, and L. Hsu (Eds.), *AIP Conf. Proc.* **1064**, 119-122 (2008 Physics Education Research Conference)
7. R. S. Russ, R. E. Scherr, D. Hammer, and J. Mikeska, "Recognizing mechanistic reasoning in scientific inquiry: A framework for discourse analysis developed from philosophy of science," *Sci. Educ.* **92**(3), 499-425 (2008)
8. R. E. Scherr, "Gesture analysis for physics education researchers," *Phys. Rev. – Spec. Topics: Phys. Educ. Res.* **4**(010101), 1-9 (2008)
9. L. D. Conlin, A. Gupta, R. E. Scherr, and D. Hammer, "The dynamics of students' behaviors and reasoning during collaborative physics tutorial sessions," in L. Hsu, C. Henderson, and L. McCullough (Eds.), *AIP Conf. Proc.* **951**, 69-72 (2007 Physics Education Research Conference)
10. R. E. Scherr, "Modeling student thinking: An example from special relativity," *Am. J. Phys.* **70**(3), 272-280 (2007)
11. R. E. Scherr and A. Elby, "Enabling informed adaptation: Open-source physics worksheets integrated with implementation resources," in P. R. L. Heron, L. McCullough, and J. Marx (Eds.), *AIP Conf. Proc.* **883**, 46-49 (2006 Physics Education Research Conference)
12. R. E. Scherr, R. S. Russ, T. J. Bing, and R. A. Hodges, "Initiation of student-TA interactions in tutorials," *Phys. Rev. – Spec. Topics: Phys. Educ. Res.* **2**, 020108-020116 (2006)
13. E. F. Redish, R. E. Scherr, and J. Tuminaro, "Reverse-engineering the solution of a 'simple' physics problem: Why learning physics is harder than it looks," *Phys. Teach.* **44**, 293-300 (2006)
14. M. C. Wittmann, P. R. L. Heron, and R. E. Scherr, "Overview of the *Foundations and Frontiers in Physics Education Research* Conference," APS Forum on Education Newsletter (Fall 2005)
15. R. E. Scherr and E. F. Redish, "Newton's zeroth law: Learning from listening to our students," *Phys. Teach.* **43**, 41-45 (2005)
16. D. Hammer, A. Elby, R. E. Scherr, and E. F. Redish, "Resources, framing, and transfer," in J. P. Mestre (Ed.), *Transfer of learning: Research and perspectives* (IAP, Greenwich, CT) (2005)
17. R. E. Scherr, "An implementation of *Physics by Inquiry* in a large-enrollment class," *Phys. Teach.* **41**(2), 113-118 (2003)
18. R. E. Scherr, "Gestures as evidence of student thinking in physics," in J. Marx, K. Cummings, and S. Franklin (Eds.), *AIP Conf. Proc.* **720**, 61-64 (2003 Physics Education Research Conference)
19. R. E. Scherr, P. S. Shaffer, and S. Vokos, "The challenge of changing deeply-held student beliefs about the relativity of simultaneity," *Am. J. Phys.* **70**(12), 1238-1248 (2002)
20. R. E. Scherr and M. C. Wittmann, "The challenge of listening: The effect of researcher agenda on data collection and interpretation," in S. Franklin, K. Cummings, and J. Marx (Eds.), *Physics Education Research Conference Proceedings 2002*
21. M. C. Wittmann and R. E. Scherr, "Student epistemological stance constraining researcher access to student thinking: An example from an interview on charge flow," in S. Franklin, K. Cummings, and J. Marx (Eds.), *Physics Education Research Conference Proceedings 2002*
22. R. E. Scherr, P. S. Shaffer, and S. Vokos, "Student understanding of time in special relativity: Simultaneity and reference frames," *Phys. Educ. Res., Am. J. Phys. Suppl.* **69**, S24-S35 (2001)
23. Contributions to *Physics by Inquiry*, L. C. McDermott and the Physics Education Group at the University of Washington (John Wiley and Sons, Inc., New York, 1996)
24. Contributions to *Tutorials in Introductory Physics*, L. C. McDermott, P. S. Shaffer, and the Physics Education Group at the University of Washington (Prentice-Hall, Upper Saddle River, NJ, 1998)

SELECTED PRESENTATIONS

- Foundations and Frontiers of Physics Education Research, June 2009.** Bar Harbor, Maine
“Qualitative analysis of video-recorded interaction,” R. E. Scherr.
- AERA Annual Meeting, April 2009.** San Diego, California
“Novice teachers of university classes: Understanding physics graduate teaching assistants,”
R. E. Scherr, R. M. Goertzen, A. Elby, and D. Hammer.
- AAPT Winter National Meeting, February 2009.** Chicago, Illinois
“Preparing perceptive teachers, K-20,” R. E. Scherr, R. M. Goertzen, A. Elby, and D. Hammer.
- International Conference of the Learning Sciences, June 2008.** Utrecht, The Netherlands
“Student behavior and epistemological framing: Examples from collaborative active-learning
activities in physics,” R. E. Scherr and D. Hammer.
- AAPT Winter National Meeting, January 2008.** Baltimore, Maryland
“Student behavior and epistemological framing: Examples from tutorials,” R. E. Scherr
and D. Hammer.
“Students’ mathematical and physical reasoning,” B. W. Frank, R. E. Scherr, and D. Hammer.
- New Jersey AAPT Section Meeting, March 2007.** Princeton, New Jersey
“Recognizing valuable student thinking in physics,” R. E. Scherr, D. Hammer, A. Elby,
and E. F. Redish.
- AAPT Summer National Meeting, August 2006.** Syracuse, New York
“Enabling informed adaptation: Open-source physics worksheets integrated with
implementation resources,” R. E. Scherr and A. Elby.
- Gordon Conference on Physics Research and Education, June 2006.** S. Hadley, Massachusetts
“Student resources for problem-solving in electricity and magnetism: Implications of a model of
learning,” R. E. Scherr.
- NARST Annual Meeting, April 2006.** San Francisco, California
“How do students frame collaborative active learning activities?” R. E. Scherr.
- AAPT Summer National Meeting, August 2005.** Sacramento, California
“Resources, framing, and transfer,” D. Hammer, A. Elby, R. E. Scherr, and E. F. Redish.
- Gordon Conference on Physics Research and Education, June 2004.** S. Hadley, Massachusetts
“Properties of student reasoning in special relativity,” R. E. Scherr and S. Vokos.
- Ontario APT Meeting, May 2004.** Oshawa, Canada
“Research-based pedagogies: Beyond content, Part 1: Epistemology,” A. Elby, E. F. Redish,
and R. E. Scherr.
- International School of Physics “Enrico Fermi,” July 2003.** Varenna, Italy
“Gestures as evidence of student thinking in physics,” R. E. Scherr.
- AAPT Winter National Meeting, January 2003.** Austin, Texas
“Questioning the questions: Playing with constraints in physics education research,”
R. E. Scherr.
“The challenge of listening: Selective attention in clinical interviews,” R. E. Scherr and
M. C. Wittmann.
- Department of Physics, University of Maine, May 2002.** Orono, Maine
“Modeling student reasoning in physics: An example from special relativity,” R. E. Scherr.
- AAPT Winter National Meeting, January 2002.** Philadelphia, Pennsylvania
“Coordinating theoretical models of student reasoning with evidence: An example from special
relativity,” R. E. Scherr.

AAPT Summer National Meeting, August 2001. **Rochester, New York**
 “An implementation of *Physics by Inquiry* in a large-enrollment class,” R. E. Scherr.

PROFESSIONAL SERVICE AND DEVELOPMENT

Physics Education Research Leadership Organizing Council, 2006-2007. **Various locations**
Chair, 2009-present; Member, 2007-present; Member ex officio, 2006-2007 (as RiPE chair)

As an elected representative of the PER community, promote and disseminate research in physics education by developing publication venues, fostering communication and exchange among professionals, publicizing events and news, and promoting access to quality resources for learning about and conducting PER.

The Physics Teacher Editorial Board, 2007-2009. **Various locations**
 Advise the editor of *The Physics Teacher* on matters relevant to the journal.

Research in Physics Education (RiPE) Committee, 2004-2007. **Various locations**
Chair, 2006-2007; Member, 2004-2007

Organize workshops and sessions for biannual national meetings of the American Association of Physics Teachers, the main professional organization of physics education researchers. Assist with negotiating self-government for this growing field.

Foundations and Frontiers of Physics Education Research, June 2009. **Bar Harbor, Maine**

Foundations and Frontiers of Physics Education Research, August 2007. **Bar Harbor, Maine**

Foundations and Frontiers of Physics Education Research, August 2005. **Bar Harbor, Maine**

Co-organizer (with P.R.L. Heron and M.C. Wittmann)

Design and plan a new conference for specialists who are active researchers in the field of physics education. The week-long residential intensive meeting provides a forum for examining and articulating the current state of the field, exploring future directions, and discussing ways to pursue the most promising avenues for future research.

Physics Education Research Conference, August 2004. **Sacramento, California**
Co-organizer (with S. Rebello and M.C. Wittmann)

Physics Education Research Conference, August 2003. **Madison, Wisconsin**
Organizer (with M.C. Wittmann)

Design and plan two-day conference adjoining the Summer National Meeting of the American Association of Physics Teachers. The conference is the main annual meeting for physics education researchers. Organizers are responsible for choosing a theme for the meeting, selecting all session formats, scheduling all events, inviting speakers and workshop leaders, and assisting in the publication of refereed conference proceedings.

NSF Summer Institute for Teachers of CIPS, August 2002. **San Diego, California**

Participate in a course to prepare middle school teachers to teach physics and physical science using the *Constructing Ideas in Physical Science* curriculum.

Optometry Admissions Test Construction Committee, 2002-2006. **Chicago, Illinois**

Construct and test items for national standardized physics examination.

AWARDS AND FELLOWSHIPS

University of Washington

Seattle, Washington

*National Science Foundation Graduate Fellow, 1994-1997.**American Association of Physics Teachers Outstanding Teaching Assistant, 1995.***Reed College**

Portland, Oregon

Thomas J. Watson Fellow, 1993-1994.

Engaged in a year of independent study and travel abroad following graduation. Directed the construction and presentation of science exhibits at an international school in Botswana.

Investigated science museums and other informal science education in south and southeast Asia.

Fannie and John Hertz Foundation Undergraduate Fellow, 1989-1993.

PROFESSIONAL AFFILIATIONS

*American Association of Physics Teachers**American Educational Research Association**International Society of the Learning Sciences*

REFERENCES

Prof. David Hammer
Departments of Physics and Curr & Instruct
Univ. of Maryland, College Park, MD 20742
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Prof. Stamatis Vokos
Department of Physics
Seattle Pacific University, Seattle, WA 98119
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Prof. Michael Wittmann
Department of Physics and Astronomy
University of Maine, Orono, ME 04401
(207) 581-1237; wittmann@umit.maine.edu

Prof. Valerie Otero
School of Education
University of Colorado, Boulder, CO 80309
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Prof. E. F. (Joe) Redish
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