2015 Physics Education Research Conference

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The theme of the 2015 Physics Education Research Conference was “Critical examination of laboratory-centered instruction and experimental research in physics education.” This conference highlighted key areas of existing lab-focused research and established priorities for new PER related to laboratory and research experiences. The nearly 400 conference attendees were encouraged to gain a deeper understanding of how laboratory and research experiences influence student learning and to consider what PER can do to assist physics departments to incorporate these learning experiences into their curricula. This year’s conference presented 214 contributed posters over two sessions, six symposium sessions with 22 talks and 5 poster presentations, three workshops, and a “custom format” on Bridging Education Research and Practice: Supporting Undergraduate Research in Physics.

The AAPT/PERC Bridging Session highlighted work by Sandra Laursen on “Challenges and opportunities for measuring student outcomes of undergraduate research” and Natasha Holmes on “Developing quantitative critical thinking in the introductory physics laboratory.” The dinner presentation highlighted work of David Brookes on “The challenge of implementing education research: A holistic and dynamical systems perspective.” Dinner was also a time of celebration: Robert Beichner was honored for his contributions to the inception and 10-year success of the Physics Review Special Topics PER. The conference closed with Helen Quinn discussing “What does a vision for k-12 science education have to do with PER?” Many contributed papers in this volume also address this year’s theme with the remainder representing the diversity of directions within PER which help this volume fulfill its purpose of providing an annual snapshot of the field.

The Editors thank this year’s conference organizers Benjamin Zwickl, Bugenia Etkina, Heather Lewandowski, and MacKenzie Stetzer, the American Association of Physics Teachers (AAPT), and the Physics Education Research Leadership and Organizing Council (PERLOC). The eleventh-hour change in venue could have spelled disaster for this year’s conference, but they took it in stride and put together yet another successful and well-run meeting.

This marks the third year that the Proceedings will be published on-line through comPADRE with sponsorship by the American Association of Physics Teachers. The Proceedings’ online submission process for contributed papers and referee reports are supported each year by Lyle Barbato and Bruce Mason who work closely with the PERC Proceedings Editors to make improvements to the system and ensure that everything runs smoothly. We wish to thank Lyle and Bruce for their excellent work and ongoing commitment to the PER community and the PERC Proceedings.

Last but not least, this volume owes its existence to the referees, who volunteer their time and expertise to help improve the quality of the papers published in the Proceedings. This year we had 181 reviewers who reviewed the 128 papers submitted to the Peer Reviewed Section.

The Editors thank: Wendy Adams, Elise Agra, Saalih Allie, Alicia Alonzo, Carolina Alvarado, Nathaniel Amos, Gordon Aubrecht, Alex Axthelm, Charles Baily, Trevor Balint, Ian Beatty,

The Editors give special thanks to Robert Beichner, Paula Heron, David Maloney, Sytil Murphy and Colin Wallace for going above and beyond by completing reviews under extremely short notice after several authors either were unable to complete their reviews at the last minute or outright refused to review by non-compliance. Without their dedication, the 2015 PERC Proceedings would not be available in such a timely fashion.

See you next summer in Sacramento!

Alice D. Churukian
Editor-in-Chief
Conference Overview

CRITICAL EXAMINATION OF LABORATORY-CENTERED INSTRUCTION AND EXPERIMENTAL RESEARCH IN PHYSICS EDUCATION

Physics, as a disciplinary community, strongly values the pursuit of theoretical, computational, and experimental lines of research. The goal of PERC 2015 is to explore ways PER can investigate and support students' development around skills, abilities, and attitudes that foster success in experimental endeavors.

For over a century, the physics curriculum has emphasized laboratory-centered instruction, and more recently, undergraduate research experiences are becoming an integral component of the curriculum (see the 2014 APS Statement). Laboratory classrooms and undergraduate research environments are well-equipped for hands-on learning that involves the practices of scientists and engineers in ways that integrate conceptual and mathematical understanding. Beyond technical abilities, traditional and reformed laboratory courses often emphasize teamwork and oral and written communication skills. The breadth and diversity of goals and strategies that can be employed in lab courses is remarkable. The physics education community needs to better understand the impact of these courses on students' professional development, their identity, their retention in STEM fields, and their development of specific abilities around scientific practices. Lab-centered classroom instruction and undergraduate research experiences are relatively unexplored by the PER community. There is an expanse of intellectually fascinating and practically significant research questions that would benefit from the breadth of research expertise and methodology represented in the PER community.

The goal of PERC 2015 is to highlight key areas of existing lab-focused research and to establish priorities for new PER related to laboratory and research experiences. Not only will these efforts support students' success, but they will also help instructors and physics departments craft their curriculum for a holistic physics learning experience that values the broad range of abilities necessary for both theoretical and experimental physics.

Organizers:
Benjamin Zwickl, Rochester Institute of Technology
Eugenia Etkina, Rutgers University
Heather Lewandowski, University of Colorado Boulder and JILA
MacKenzie Stetzer, University of Maine

The organizing committee of the PERC 2015 would like to express gratitude to the following individuals for their invaluable assistance in creating this conference:

The plenary speakers: Sandra Laursen, Natasha Holmes, David Brookes, and Helen Quinn; Lyle Barbato and Bruce Mason with ComPADRE; Tiffany Hayes, Cerena Cantrell, Janet Lane, and Pearl Watson from AAPT; and the PERC Proceedings Editors: Alice Churukian, Dyan Jones, and Lin Ding.
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<td>Annapolis and nearby spaces</td>
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<td>Even-numbered posters will be presented during the second 45 minutes of the session.</td>
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<td>Talk Symposium: New developments in high school labs</td>
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<td>12:00pm –</td>
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