<table>
<thead>
<tr>
<th>Year</th>
<th>Title</th>
<th>Publisher</th>
<th>ISBN</th>
</tr>
</thead>
</table>

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# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>ix</td>
</tr>
<tr>
<td>Program</td>
<td>xi</td>
</tr>
<tr>
<td>Poster Title and Authors</td>
<td>xiii</td>
</tr>
</tbody>
</table>

## INVITED PAPERS

- **Is Transfer Ubiquitous or Rare? New Paradigms for Studying Transfer**  
  J. Mestre  
  Page: 3
- **How Do You Hit a Moving Target? Addressing the Dynamics of Students’ Thinking**  
  D. E. Meltzer  
  Page: 7
- **Twenty Questions for PER: How Does it All Fit Together?**  
  E. F. Redish and M. C. Wittmann  
  Page: 11
- **Seeding Change: The Challenges of Transfer and Transformation of Educational Practice and Research in Physics (Part I)**  
  N. Finkelstein and E. Price  
  Page: 15
- **Seeding Change: The Challenges of Transfer and Transformation of Educational Practice and Research in Physics (Part II)**  
  E. Price and N. Finkelstein  
  Page: 19
- **Transfer of Learning in Quantum Mechanics**  
  C. Singh  
  Page: 23
- **A Repeat Performance? Challenges in Developing Robust Conceptual Understanding in Quantum Mechanics**  
  B. S. Ambrose  
  Page: 27
- **Student Learning in Upper-Level Thermal Physics: Comparisons and Contrasts with Students in Introductory Courses**  
  D. E. Meltzer  
  Page: 31
- **Tracing Difficulties with Relativistically Invariant Mass to Difficulties with Vector Addition of Momentum in Newtonian Contexts**  
  A. Boudreaux  
  Page: 35
- **Transfer of Learning through Gender and Ethnicity**  
  A. M. Calder and E. L. Ashbaugh  
  Page: 39

## PEER-REVIEWED PAPERS

- **The Design and Validation of the Colorado Learning Attitudes about Science Survey**  
  W. K. Adams, K. K. Perkins, M. Dubson, N. D. Finkelstien, and C. E. Wieman  
  Page: 45
- **Development of an Instrument for Evaluating Anxiety Caused by Cognitive Conflict**  
  Y. Kim and L. Bao  
  Page: 49
- **Measuring Conceptual Change in College Students’ Understanding of Lunar Phases**  
  R. S. Lindell  
  Page: 53
- **Probing Students’ Epistemologies Using Split Tasks**  
  T. L. McCaskey and A. Elby  
  Page: 57
- **Correlating Student Beliefs with Student Learning Using the Colorado Learning Attitudes about Science Survey**  
  Page: 61
- **Student Understanding of Symmetry and Gauss’s Law**  
  C. Singh  
  Page: 65
- **Rate of Change and Electric Potential**  
  R. Allain and R. Beichner  
  Page: 69
- **Diminishing Forces—Implications for Contextual Dependence of a Misconception**  
  A. R. Allbaugh  
  Page: 73
- **Student Understanding of Gravitational Potential Energy and the Motion of Bodies in a Gravitational Field**  
  M. E. Loverude  
  Page: 77
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Understanding of Sound Propagation: Research and Curriculum Development</td>
<td>81</td>
</tr>
<tr>
<td>K. V. P. Menchen and J. R. Thompson</td>
<td></td>
</tr>
<tr>
<td>Contrasts in Student Understanding of Simple E&amp;M Questions in Two Countries</td>
<td>85</td>
</tr>
<tr>
<td>G. J. Aubrecht, II and C. Raduta</td>
<td></td>
</tr>
<tr>
<td>Grounding Inquiry-based Teaching and Learning Methods in Physics Experiences for Prospective Elementary Teachers</td>
<td>89</td>
</tr>
<tr>
<td>G. J. Aubrecht, II</td>
<td></td>
</tr>
<tr>
<td>Virtual Reality in Introductory Physics Laboratories</td>
<td>93</td>
</tr>
<tr>
<td>D. Demaree, S. Stonebraker, W. Zhao, and L. Bao</td>
<td></td>
</tr>
<tr>
<td>Helping Preservice Teachers Implement and Assess Research-based Instruction in K-12 Classrooms</td>
<td>97</td>
</tr>
<tr>
<td>D. L. Messina, L. S. DeWater, and M. R. Stetzer</td>
<td></td>
</tr>
<tr>
<td>Can Computer Simulations Replace Real Equipment in Undergraduate Laboratories?</td>
<td>101</td>
</tr>
<tr>
<td>N. D. Finkelstien, K. K. Perkins, W. Adams, P. Kohl, and N. Podolefsky</td>
<td></td>
</tr>
<tr>
<td>Learning Physics by Listening to Children</td>
<td>105</td>
</tr>
<tr>
<td>D. B. Harlow and V. K. Otero</td>
<td></td>
</tr>
<tr>
<td>Teaching, Learning and Physics Education Research: Views of Mainstream Physics Professors</td>
<td>109</td>
</tr>
<tr>
<td>C. Henderson and M. H. Dancy</td>
<td></td>
</tr>
<tr>
<td>Beyond the Individual Instructor: Systemic Constraints in the Implementation of Research-Informed Practices</td>
<td>113</td>
</tr>
<tr>
<td>M. H. Dancy and C. Henderson</td>
<td></td>
</tr>
<tr>
<td>Using the System Schema Representational Tool to Promote Student Understanding of Newton's Third Law</td>
<td>117</td>
</tr>
<tr>
<td>B. E. Hinrichs</td>
<td></td>
</tr>
<tr>
<td>Representational Format, Student Choice, and Problem Solving in Physics</td>
<td>121</td>
</tr>
<tr>
<td>P. B. Kohl and N. D. Finkelstien</td>
<td></td>
</tr>
<tr>
<td>Attitudes of Undergraduate General Science Students Toward Learning Science and the Nature of Science</td>
<td>125</td>
</tr>
<tr>
<td>J. Marx, S. Mian, and V. Pagonis</td>
<td></td>
</tr>
<tr>
<td>Preliminary Results of Gender Equity Variations in a Large Active-Learning Introductory Physics Course Due to Laboratory Activity Instructions</td>
<td>129</td>
</tr>
<tr>
<td>M. L. McKinnon and W. H. Potter</td>
<td></td>
</tr>
<tr>
<td>Development of Scientific Abilities in a Large Class</td>
<td>133</td>
</tr>
<tr>
<td>S. Murthy and E. Etkina</td>
<td></td>
</tr>
<tr>
<td>No Single Cause: Learning Gains, Student Attitudes, and the Impacts of Multiple Effective Reforms</td>
<td>137</td>
</tr>
<tr>
<td>S. J. Pollock</td>
<td></td>
</tr>
<tr>
<td>Teacher and Curriculum Factors that Influence Middle School Students’ Sense-Making Discussions of Force/Motion</td>
<td>141</td>
</tr>
<tr>
<td>C. Sandifer</td>
<td></td>
</tr>
<tr>
<td>The Role of Evaluative Abilities in Physics Learning</td>
<td>145</td>
</tr>
<tr>
<td>A. R. Warren</td>
<td></td>
</tr>
<tr>
<td>Concerning Scientific Discourse about Heat</td>
<td>149</td>
</tr>
<tr>
<td>D. Brookes, G. Horton, A. Van Heuvelen, and E. Etkina</td>
<td></td>
</tr>
<tr>
<td>Introductory College Physics Students’ Explanations of Friction and Related Phenomena at the Microscopic Level</td>
<td>153</td>
</tr>
<tr>
<td>E. G. Corpuz and N. S. Rebello</td>
<td></td>
</tr>
<tr>
<td>Transfer between Paired Problems in an Interview</td>
<td>157</td>
</tr>
<tr>
<td>K. E. Gray and N. S. Rebello</td>
<td></td>
</tr>
<tr>
<td>Sample Exams and Transfer in Introductory Mechanics</td>
<td>161</td>
</tr>
<tr>
<td>C. Koleci</td>
<td></td>
</tr>
<tr>
<td>Alternative Conceptions, Memory, and Mental Models in Physics Education</td>
<td>165</td>
</tr>
<tr>
<td>Student Descriptions of Refraction and Optical Fibers</td>
<td>169</td>
</tr>
<tr>
<td>F. Mateycik, D. J. Wagner, J. J. Rivera, and S. Jennings</td>
<td></td>
</tr>
<tr>
<td>Retention and Transfer from Trigonometry to Physics</td>
<td>173</td>
</tr>
<tr>
<td>D. J. Ozimek, P. V. Engelhardt, A. G. Bennett, and N. S. Rebello</td>
<td></td>
</tr>
</tbody>
</table>
Preface

With this year’s Proceedings we begin a new tradition: the Preface is written by the outgoing editor, who can reflect on changes that have occurred. The Proceedings are now four years old, and have shared many of the growing pains experienced by the Physics Education Research Community. We have grappled with the explosive growth in both quantity and breadth of research. Maintaining a high quality while allowing emerging areas the freedom to grow remains a critical issue both for the Proceedings and the PER community. One measure of this growth continues to be the increasing number of papers we receive; 51 this year, 30 times as many as only two years ago.

The list of reviewers needed has also grown, and we thank the following seventy individuals who gave their time to help ensure that the high standards continue to be met: Wendy Adams, Rhett Allain, Alicia Allbaugh, Brad Ambrose, Gordon Aubrecht, Lei Bao, Bob Beichner, Joseph Beuckman, Scott Bonham, Eric Brewe, David Brookes, Kerry Brown, Alice Churukian, Andrew Crouse, Karen Cummings, Melisa Dancy, Dewey Dykstra, Andy Elby, Paula Engelhardt, Jerome Epstein, Eugenia Etkina, Noah Finkelstein, Tom Foster, Kara Gray, Richard Hake, Danielle Harlow, Kathy Harper, Kenneth Heller, Charles Henderson, Brant Hinrichs, Zdeslav Hrepic, Leon Hsu, Steve Kanim, Chris Kautz, Carolann Kolec, Rebbecca Lindell, Mike Loverude, Fran Mateycik, Tim McCaskey, Laura McCullough, Mark McKinnon, David Meltzer, Katherine Menchen, Donna Messina, Taha Mzoughi, Luanna Ortiz, Valerie Otero, K. K. Perkins, Steven Pollock, David Pritchard, David Rosengrant, Mel Sabella, Homeyra Sadaghiani, Cody Sandifer, Tim Seltzer, Peter Shaffer, Manjula Sharma, Chandralekha Singh, MacKenzie Stetzer, Robert Teese, Beth Ann Thacker, John Thompson, Alan Van Heuvelen, Stamatis Vokos, DJ Wagner, Rasil Warnakulasooriya, Aaron Warren, Carl Wienman, Edit Yerushalmi, and Xueli Zou.

There are still issues to resolve. While the electronic submission and distribution of papers should in principle make the reviewing process easier, in practice it has led to unacceptable delays. We apologize for the increasing length of publication time; it remains the single biggest issue I wish we could resolve. Instructions to reviewers is a smaller issue. Our goal is to have every paper reviewed to same standards; however, with seventy-three reviewers, ranging from graduate students to professor emeriti, this is a challenge.

When we first started the Proceedings, our hopes were to capture a snapshot of the PER community and address our belief that much good PER went unpublished. The Proceedings thus could fill a unique niche in PER literature, and be a valuable resource for the community. I hope we have succeeded, and wish the future editors the best of luck in the challenges ahead.

Scott Franklin
Outgoing Editor
PROGRAM
2004 PHYSICS EDUCATION RESEARCH CONFERENCE
SACRAMENTO, CALIFORNIA

Wednesday, August 4

4:00 - 6:00 pm: AAPT/PERC Bridging Session: Invited Talks & Panel Discussion
   4:00 pm: Is Transfer Ubiquitous or Rare? New Paradigms for Studying Transfer
           Jose Mestre, University of Massachusetts, Amherst
   4:30 pm: Assessing Transfer of Conceptual Understanding
           Karen Cummings, Southern Connecticut State University
   5:00 pm: Measuring the Transfer of Mathematical Skills
           Manjula Sharma, University of Sydney, Australia
   5:30 pm: Panel Discussion
           Discussant: To be announced

6:00 - 8:00 pm: Free Time

8:00 - 10:00 pm: Contributed Poster Session

9:00 - 10:00 pm: Round Table Discussion, Parallel Sessions

Thursday, August 5

8:00 - 8:15 am: Orientation

8:15 - 9:45 am: Workshops (W) & Targeted Poster (TP) Sessions - I
   W-A: Getting Articles into Journals
       Robert Beichner, North Carolina State University
   W-B: The Physics Portal: Building a Self-Sustaining Internet-based Education Network
       David Hestenes, Arizona State University; Bernard Haisch, ManyOne Network
   W-C: Laboratory Math & Science for Cognitive Development - Dealing with the Real Level of our
        Physics Students
       Jerome Epstein, Polytechnic University
   TP-A: Challenges for the PER Community: Exploration of Common Assumptions, Open Questions &
        Current Controversies
       Organizer: Paula Heron, University of Washington
   TP-B: Beyond Student Transfer: Graduate, Postdoc, and Faculty Development & The Road to Sustainable,
        Scalable Inclusion of PER
       Organizers: Noah Finkelstein, University of Colorado; Melissa Dancy, University of North Carolina
   TP-C: Going Up? - Learning Transfer Among Students in Upper-Level Physics Courses
       Organizer: Chandralekha Singh, University of Pittsburgh; Bradley Ambrose, Grand Valley State University

9:45 - 10:15 am: Break
10:15 am - 12:15 pm: Invited Talks & Panel Discussion

10:15 am: What Coordination has to say About Transfer
Andrea diSessa, University of California, Berkeley

10:45 am: Innovation and Efficiency in Transfer
Daniel Schwartz, Stanford University

11:15 am: When You don't See it -- Why not?
Zbigniew Dziembowski, Temple University

11:45 am: Panel Discussion
Discussant: Jose Mestre, University of Massachusetts, Amherst

12:15 - 1:45 pm: Luncheon Banquet & Talk
Duncan McBride, National Science Foundation

1:45 - 3:15 pm: Parallel Workshops (W) & Targeted Poster (TP) Sessions - II

W-A: Getting Articles into Journals
Robert Beichner, North Carolina State University

W-D: Transferring PER Results from the Domain of the Researcher to the Domain of the Practitioner
Kenneth Heller, University of Minnesota

W-B: The Physics Portal: Building a Self-Sustaining Internet-based Education Network
David Hestenes, Arizona State University; Bernard Haisch, ManyOne Network

TP-C: Going Up? - Learning Transfer Among Students in Upper-Level Physics Courses
Organizer: Chandralekha Singh, University of Pittsburgh; Bradley Ambrose, Grand Valley State University

TP-D: Issues in Studying Transfer of Problem Solving Skills
Organizers: Kathleen A. Harper, The Ohio State University; Thomas Foster, Southern Illinois University – Edwardsville; David P. Maloney, Indiana University, Purdue University, Fort Wayne

TP-E: Determining Transfer of Learning with Longitudinal Studies Using Grade & Demographic Data on Individual Students
Organizer: Wendell Potter, University of California, Davis

3:15 - 3:45 pm: Break

3:45 - 5:15 pm: Parallel Workshops (W) & Targeted Poster (TP) Sessions - III

W-D: Transferring PER Results from the Domain of the Researcher to the Domain of the Practitioner
Kenneth Heller, University of Minnesota

W-C: Laboratory Math & Science for Cognitive Development - Dealing with the Real Level of our Physics Students
Jerome Epstein, Polytechnic University

TP-A: Challenges for the PER Community: Exploration of Common Assumptions, Open Questions & Current Controversies
Organizer: Paula Heron, University of Washington

TP-B: Beyond Student Transfer: Graduate, Postdoc, and Faculty Development & The Road to Sustainable, Scalable Inclusion of PER
Organizers: Noah Finkelstein, University of Colorado; Melissa Dancy, University of North Carolina

TP-D: Issues in Studying Transfer of Problem Solving Skills
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TP-E: Determining Transfer of Learning with Longitudinal Studies Using Grade & Demographic Data on Individual Students
Organizer: Wendell Potter, University of California, Davis

5:15 - 6:30 pm: Break

6:30 - 8:00 pm: Dinner Banquet
Poster Titles and Authors

The Design and Validation of the Colorado Learning Attitudes about Science Survey
Wendy Adams, Katherine Perkins, Noah Finkelstein, Carl Wieman, and Michael Dubson, University of Colorado, Boulder

Evaluating and Using BEMA (Brief Electricity & Magnetism Assessment)
Lin Ding, North, Robert Beichner, Ruth Chabay, and Bruce Sherwood, North Carolina State University

Understanding the MPEX 'Expert': A Comparison with Traditional Physics Faculty
Elizabeth Gire, Edward Price, and Barbara Jones, University of California, San Diego

A Conceptual Hierarchy of Lunar Phases?
Aaron Hines and Rebecca Lindell, Southern Illinois University - Edwardsville

Eliciting and Representing Hybrid Mental Models
Zdeslav Hrepic, Dean Zollman, and N. Sanjay Rebello, Kansas State University

Development of an Instrument for Evaluating Anxiety Caused by Cognitive Conflict
Yeounsoo Kim and Lei Bao, The Ohio State University

Using a Q-type Assessment Instrument to Study Correlation Between Teacher Attitudes and Student Perceptions of Physics Laboratories
Yuhfen Lin and Dedra Demaree, The Ohio State University; Xueli Zou, California State University – Chico; Gordon Aubrecht, The Ohio State University

Measuring Conceptual Change in College Students’ Understanding of Lunar Phases
Rebecca Lindell, Southern Illinois University - Edwardsville

Student “Splits” Between Intuition and Scientist Answers*
Timothy McCaskey and Andrew Elby, University of Maryland

A Survey to Investigate Student Understanding of Quantum Tunneling
Jeffrey Morgan and Michael Wittmann, University of Maine

Correlating Student Attitudes with Student Learning using the Colorado Learning Attitudes about Science Survey
Katherine Perkins, Wendy Adams, Steven Pollock, Carl Wieman, and Noah Finkelstein, University of Colorado, Boulder

Student Understanding of Gauss’ Law of Electricity
Chandralekha Singh and Paul Reilly, University of Pittsburgh

From Students’ Perspectives: A Q-type Assessment Instrument*
Xueli Zou, California State University – Chico; Dedra Demaree, Yuhfen Lin, and Gordon Aubrecht, The Ohio State University

Rate of Change and Electric Potential
Rhett Allain and Robert Beichner, North Carolina State University

Diminishing Forces – Implications of a Misconception
Alicia Allbaugh, Rochester Institute of Technology

Assessing Student Understanding of Wave Amplitude and Intensity
Lei Bao and Dedra Demaree, The Ohio State University

Student Difficulties with Graphical Representation of Vector Products: Crossing and Dotting Beyond t’s and i’s
Warren Christensen, Ngoc-Loan Nguyen, and David Meltzer, Iowa State University

Identifying Student Concepts of “Gravity”
Roger E. Feeley R. Thompson, and Michael C. Wittmann, University of Maine

Student Understanding of Gravitational Potential Energy and Moving Objects
Michael Loverude, California State University - Fullerton

Student Understanding of Sound Propagation: Research and Curriculum Development
Katherine Menchen and John Thompson, University of Maine
Contrasts in Student Understanding of Simple E&M Questions in Two Countries
Cristian Raduta and Gordon Aubrecht, The Ohio State University

Design-Based Research: A Primer for Physics-Education Researchers
Richard Hake, Indiana University

Are Physics Graduate Students’ Beliefs about Teaching and Learning Consonant?
Yuhfen Lin and Gordon Aubrecht, The Ohio State University

The Journal of Research in Science Teaching
Edward F. Redish and J. Randy McGinnis, University of Maryland; Angelo Collins, Knowles Science Teaching Foundation

Can Inquiry Experiences in Physics Class Change Students’ Preconceptions about Teaching?
Gordon Aubrecht, The Ohio State University

Use of a Hands-on Lab Exam to Investigate how Physics Students Transfer Knowledge from Lecture to the Laboratory
Duane Deardorff, University of North Carolina

Virtual Reality Experiments in Introductory Physics Laboratories
Dedra Demarem, Stephen Stonebraker, and Lei Bao, The Ohio State University

Helping Preservice Teachers Implement and Assess Research-based Instruction in K-12 Classrooms
Lezlie S. DeWater, Donna Messina, and MacKenzie Stetzer, University of Washington

Can Computer Simulations Replace Real Equipment in Undergraduate Laboratories?
Noah Finkelstein, Katherine Perkins, Wendy Adams, and Patrick Kohl, University of Colorado, Boulder

Learning Physics by Listening to Children
Danielle Harlow and Valerie Otero, University of Colorado, Boulder

Evaluating Options for Combating Post-Exam Syndrome
Kathleen Harper, The Ohio State University; Matt Finnerty and Robert W. Brown, Case Western Reserve University

Teaching, Learning and PER: Views from Mainstream Faculty
Charles Henderson, Western Michigan University; Melissa Dancy, University of North Carolina - Charlotte

Electrostatic & Magnetism TIPERs*
Curtis Hieggelke, Joliet Junior College; Steve Kanim, New Mexico State University; David Maloney, Indiana University Purdue University - Fort Wayne; Thomas O'Kuma, Lee College

Using The Schema Conceptual Tool to Promote Student Understanding of Newton’s 3rd Law
Brant Hinrichs, Drury University

Representational Format, Student Choice, and Problem Solving in Physics
Patrick Kohl and Noah Finkelstein, University of Colorado, Boulder

In Class Polling: An Instant Feedback of Students Learning Mode
Pengfei Li, Neville Reay, and Lei Bao, The Ohio State University

Attitudes of General Science Students Toward Learning Science and the Nature of Science
Jeff Marx, Shabbir Mian, and Vasilis Pagonis, McDaniel College

Gender Equity Variations in a Large Active-Learning Introductory Physics Course
Mark McKinnon, University of California, Davis

Transfer of Teaching: an Experiment of Opportunity
Robert A. Morse; H. Wells Wulsin, Harvard University

Helping Students Learn to Design Experiments in a Large-enrollment Introductory Laboratory Course
Sahana Murthy and Eugenia Etkina, Rutgers University

Steven Pollock, University of Colorado, Boulder
Teacher and Curriculum Factors that Influence Middle School Students' Sense-Making Discussions of Force/Motion  
Cody Sandifer, Towson State University

The Role of Evaluation Abilities in Student Learning & Performance  
Aaron Warren and Alan Van Heuvelen, Rutgers University

Student Participation in Normative Behaviors in a Physics for Elementary Teachers (PET) Classroom*  
Benjamin Williams, San Diego State University

Generated Analogies as Assertions of Categorization  
Leslie Atkins, University of Maryland

Active versus Passive Learning  
Florin Bocaneala and Lei Bao, The Ohio State University

Concerning Scientific Discourse about Heat  
David Brookes; George Horton; Alan Van Heuvelen and Eugenia Etkina, Rutgers University

Introductory College Students’ Explanations of Friction and Related Phenomena at the Microscopic Level  
Edgar Corpuz and N. Sanjay Rebello, Kansas State University

Evidence of Transfer in Interview Data  
Paula Engelhardt, Kansas State University

Model what you Preach: Explicitly Articulated Interactions for Transfer of Concepts by Physics Graduate Teaching Assistants  
Cathy Ezrailson

Transfer between Paired Problems  
Kara Gray and N. Sanjay Rebello, Kansas State University

Transfer: the Advantage of Simple Symbols  
Andrew Heckler, Jennifer Kaminski, and Vladimir Sloutsky, The Ohio State University

Sample Exams and Transfer in Introductory Mechanics  
Carol Koleci, Charles Chretien, and Warren Turner, Worcester Polytechnic Institute

Alternative Conceptions, Memory, & Mental Model in Physics Education  
Gyoungho Lee, Seoul National University; Jiyeon Park; Yeonsoo Kim; Lei Bao, The Ohio State University

Investigating Students' Knowledge of Particle Structure in Different Cultures  
Cui Lili, Dean Zollman, and N. Sanjay Rebello, Kansas State University

Student Descriptions of Refraction and Optical Fibers  
Fran Mateycik, DJ Wagner, Rensselaer Polytechnic Institute; JJ Rivera; Sybillyn Jennings, Sage College

Transfer of Learning from Trigonometry to Physics  
Darryl Ozimek, Paula V. Engelhardt, and N. Sanjay Rebello, Kansas State University

Analogical Scaffolding of Abstract Ideas in Physics  
Noah Podolefsky, Wendy Adams, and Noah Finkelstein, University of Colorado, Boulder

Learning and Knowledge Transfer between Physics Problems  
David Pritchard, Elsa-Sofia Morote, and Rasil Warnakulasooriya, Massachusetts Institute of Technology

Multiple Representations: A Quantitative Study on Students use of Free-Body Diagrams in Large Lecture Classes.  
David Rosengrant, Alan Van Heuvelen, and Eugenia Etkina, Rutgers University

Student Learning of Quantum Mechanics  
Homeyra Sadaghiani and Lei Bao, The Ohio State University

The Structure of Intermediate Mechanics Students' Physics and Mathematics Intuitions  
Eleanor C. Sayre and Michael C. Wittmann, University of Maine

Students’ Conceptions about Probability in a Double-slit Experiment for Electrons and Potential Well Problems  
Pornrat Wattanakasitswich and Kenneth Krane, Oregon State University
What Changes occur during Conceptual Change?
Michael Wittmann, University of Maine

Physics Teachers' Studying Students' Perceptions Required For Transfer
Edit Yerushalmi, Bat Sheva Eylon, and Rachel Seggev, Weizmann Institute

Physics Teachers' Studying Students' Perceptions Required For Transfer
Karen Cummings, Southern Connecticut State University; Edward Grillo, Weizmann Institute

A Web-based Tool for the Analysis of Concept Inventory Data
Joseph Beuckman and Rebecca Lindell, Southern Illinois University – Edwardsville; Scott Franklin, Rochester Institute of Technology

Feedback with Web-based Homework and PADs
Scott Bonham, Western Kentucky University

Computerized Interactive Problem-solving Coaches
Leon Hsu and Ken Heller, University of Minnesota

Student Difficulties with Computer Modeling: Using Protocol Data to Revise Instruction
Matthew Kohlmyer, Ruth Chabay, and Bruce Sherwood, North Carolina State University

Toward an Effective use of Voting Machines in Physics Lectures
Neville Reay, Lei Bao, and Pengfei Li, The Ohio State University; Rasil Warnakulasooriya, Massachusetts Institute of Technology

A Study of Student Use of an Online Message Board in an Introductory Physics Class
Wenjuan Song, Taha Mzoughi, and Anastasia Elder, Mississippi State University

Using Electronic Interviews to Explore Student Understanding
DJ Wagner, Rensselaer Polytechnic Institute; JJ Rivera; Fran Mateycik, Rensselaer Polytechnic Institute; Sybillyn Jennings, Sage College

Time for Completion Curves for Physics Problems
Rasil Warnakulasooriya and David Pritchard, Massachusetts Institute of Technology