2007 PHYSICS EDUCATION RESEARCH CONFERENCE

Greensboro, North Carolina  1 - 2 August 2007

EDITORS
Leon Hsu
Charles Henderson
Laura McCullough

AMERICAN INSTITUTE OF PHYSICS

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PREFACE

The theme of the Physics Education Research Conference in August 2007 was “Cognitive Science and Physics Education Research.” The invited papers in this volume and several of the contributed papers represent the intersections and interstices of these fields. The Editors thank the organizers of the conference, Steve Kanim, Michael Loverude, and Chandralekha Singh, for their work in producing a successful and exciting meeting.


Over its seven years in print, the Proceedings has gone from a young publication working through its growing pains to a mature venue for publishing PER results and I am proud of the part I have played in that ongoing process. But there is always room for improvement and every year the editors work to streamline the submission and review process. I hope and expect the PERC Proceedings will continue to serve the PER community for many years, and I know that I leave the process in good hands as I end my time as editor.

Laura McCullough
Outgoing Editor
# PROGRAM

**2007 PHYSICS EDUCATION RESEARCH CONFERENCE**
**GREENSBORO, NORTH CAROLINA**

**WEDNESDAY, August 1, 2007**

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<td>3:30 - 5:30</td>
<td><strong>Bridging Session: Invited Talks &amp; Panel Discussion</strong></td>
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|            | Making Physics Learning Inviting - A View from Cognitive Science  
|            | *Janet Kolodner, Georgia Tech*                                                                peats                                                                                          |
|            | Problem Solving and Learning for Physics Education  
|            | *Brian Ross, University of Illinois at Urbana-Champaign*                                                                                  |
|            | Naive Physics/Savvy Science: Causal Learning in Very Young Children ... and the Rest of Us  
|            | *Laura Schulz, MIT*                                                                                                                         |
| 6:00 - 8:00| **Dinner Banquet**                                                                                                                                                                                   |
|            | *President: Steve Kanim*  
|            | *Banquet Speaker: Art Kramer, University of Illinois at Urbana Champaign*                                                                   |
|            | Cognitive Neuroscience Explorations of Cognitive Plasticity & Human Performance                                                                                                                        |
| 8:00 - 10:00| **Contributed Poster Session**                                                                                                                                                                        |

**THURSDAY, August 2, 2007**

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<td><strong>Workshops, Targeted Poster Sessions &amp; Roundtable Discussions- I</strong></td>
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| (Parallel Sessions) | Workshop A:  
|            | Cognitive Analysis of Student Learning Using LearnLab  
|            | *Rett van de Sande and Kurt VanLohn, University of Pittsburgh*                                                                                 |
|            | Workshop B:  
|            | Physics Learning in the Context of Scaffolded Diagnostic Tasks  
|            | *Erit Yerushalmi & Bat Sheva Eylon, Weizmann Institute of Science Chandralekha Singh, University of Pittsburgh*                                  |
|            | **Targeted Poster Session TP-A**:  
|            | Experimental Paradigms from Cognitive Science to Learn About Learning  
|            | *Jose Mestre, University of Illinois, Urbana-Champaign*                                                                                       |
|            | **Roundtable Discussion A**:  
|            | What We Can Learn from Neuroscience from Encoding to n-Coding  
|            | *Nathaniel Lasry, Harvard University*                                                                                                         |
|            | *Mark Aulls, McGill University*                                                                                                             |
| 9:45 - 10:00| **Break**                                                                                                                                                                                             |
| 10:00 - 12:00| Invited Talks & Panel Discussion (Session II)                                                                                                                                                           |
|            | Cognitive Science: The Science of the (Nearly) Obvious  
|            | *Bruce Sherin, Northwestern University*                                                                                                       |
|            | Facilitating Conceptual Learning Through Analogy and Explanation  
|            | *Timothy Nokes, University of Pittsburgh*                                                                                                    |
|            | Socializing Learning and Transfer  
<p>|            | <em>Dan Schwartz, Stanford University</em>                                                                                                           |</p>
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<td><em>Karen Cummings, Southern Connecticut State University</em></td>
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<td><em>Tetyana Antimirova, Ryerson University, Toronto, Ontario</em></td>
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<td><em>Brett van de Sande and Kurt VanLehn, University of Pittsburgh</em></td>
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<td>Student Views of Learning in a First Semester College Physics Course: A Study Using Q Methodology</td>
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<td><em>Susan Ramlo, The University of Akron</em></td>
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POSTER TITLES AND AUTHORS

Physics Problem Solving Component Skills and Evaluation
Adams, Wendy (wendy.adams@colorado.edu) University of Colorado at Boulder
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Different Types of Mathematical Justification in Upper Level Physics
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College Students’ Responses to Inquiry-based Group Work in a Reformed Pedagogy Classroom
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Mapping Student Reasoning about Math- and Physics-oriented Differential Equation Solutions
Black, Katrina E. (katrina.black@umit.maine.edu) University of Maine Department of Physics and Astronomy
Wittmann, Michael C. (wittmann@umit.maine.edu) University of Maine Department of Physics and Astronomy

New Dimensions to Probing Student Thinking about Oscillations in Two Dimensions
Ambrose, Bradley (ambroseb@gvsu.edu) Grand Valley State University

Measuring Student Effort and Engagement in an Introductory Physics Course
Bonham, Scott (scott.bonham@wku.edu) Western Kentucky University

Investigating Peer Scaffolding in Learning and Transfer of Learning Using Teaching Interviews*
Aryal, Bijaya (bijaya@phys.ksu.edu) Kansas State University
Zollman, Dean (dzollman@phys.ksu.edu) Kansas State University

Voltage is the Most Difficult Subject for Students in Physics by Inquiry’s Electric Circuits Module
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Aubrecht, Gordon (aubrecht@mps.ohio-state.edu) The Ohio State University at Marion

Comparison of Student Perceptions of Three Different Physics by Inquiry Classes
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Do Introductory Astronomy Texts Promote Higher Order Thinking?
Bracey, Georgia (georgia_bracey@hotmail.com) Southern Illinois University Edwardsville
Lindell, Rebecca (rlindel@siue.edu) Southern Illinois University Edwardsville

Humans, Intentionality, Experience and Tools for Learning: Some Contributions from Post-Cognitive Theories to the Use of Technology in Physics Education.
Bernhard, Jonte (jonbe@itn.liu.se) Engineering Ed. Res. Group, ITN, Campus Norrköping, Linköping University

Improving the Spread of PER-based Instructional Approaches: A Case Study of Dissemination within the Modeling Physics Project
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Scaffolded Reflection: A Chemist's View of Conceptual Change
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Students’ Difficulties with Concepts Related to Conductors and Insulators
Bilak, Joshua (jdbilak@gmail.com) University of Pittsburgh
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The Dynamics of Students’ Behaviors and Reasoning during Collaborative Physics Tutorial Sessions
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The Use of Hands-On and Minds-On Modeling Activities in Improving Students’ Understanding of Microscopic Friction
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Problem Solving Behaviors of Math and Science Teachers: Striving for an Answer or for Understanding
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From FCI to CSEM to Lawson Test: A Report on Data Collected at a Community College.
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The Effectiveness of a Physical Science by Inquiry Program for K-12 Teachers*
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Spending Time on Design: Does it Hurt Physics Learning?
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From Physics to Biology: Helping Students Attain All-terrain Knowledge
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Karelina, Anna (anna.karelina@gmail.com) Rutgers University, Graduate School of Education
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Visual Physics: A Case Correlation for Introductory Calculus-based Physics Re-Design
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Loving, Cathleen C (cloving@tamu.edu) Texas A&M University

Using a Recognition Memory Test to Measure Expert-Novice Differences in the Encoding of Physics Diagrams.
Feil, Adam (adamfeil@uiuc.edu) University of Illinois
Mestre, Jose (mestre@uiuc.edu) University of Illinois

Using Models of Student Thinking to Predict Variability in Responses to Motion Questions
Frank, Brian (bwfrank@physics.umd.edu) University of Maryland
Kanim, Stephen New Mexico State University
Ortiz, Luanna Arizona State University
Exploring Student Application of Deductive Reasoning Resources in a Physics Context
Gaffney, Jon D. H. (jdgaffney@ncsu.edu) North Carolina State University
Weatherford, Shawn A. (sawethe@ncsu.edu) North Carolina State University
Chabay, Ruth W. (rwchabay@ncsu.edu) North Carolina State University

Do They See What We See? College Students Impressions Images of Lunar Phases
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Baker, Erin (ebaker@siue.edu) Southern Illinois University Edwardsville
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Beyond Expert-novice Distinctions: The Problem Solving Characteristics of Physics Majors
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Priming Epistemological Framing in Introductory Physics Students
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Coordination of Mathematical and Physical Resources by Physics Graduate Students
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A Dynamic Model of Expert and Novice Ontologies in Physics
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Hammer, David (davidham@umd.edu) Department of Physics, University of Maryland, College Park

Cognitive Science and Physics Education Research: ‘What We Have Here Is a Failure to Communicate.’
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How Elementary Teachers Use What We Teach
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Student Categorization of Problems: An Extension
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Freuler, Richard J. First-Year Engineering Program, The Ohio State University
Demel, John T. First-Year Engineering Program, The Ohio State University

Students’ Ideas About a Blender and Perceptions of Scaffolding Activities
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Evaluation of the Physics and Astronomy New Faculty Workshop
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Overcoming Undergraduate Student Difficulty in Understanding Curl through Feedback Learning Materials
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Categories of Students’ Responses to an Anomalous Section in Symon Mechanics: A Critique of the Conservation Laws
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Expert and Novice use of Multiple Representations in Physics Problem Solving
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Scientific Inquiry Using a Computer Simulation: Similarities and Differences in Students’ Learning Processes at an International School
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Re-conceiving How Teachers Teach, and How Students Learn Physics with Analogies
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Exploring the Intersections of Personal Epistemology, Public Epistemology, and Affect
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Future Elementary Teachers’ Epistemological Beliefs and Views about the Nature of Science before and after a ’Reformed’ Conceptual Physics Course
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Investigating Students’ Ideas about Wavefront Aberrometry*
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Students Creating Mathematical Meaning in Mechanics: Signs in Scalar Equations
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A Preliminary Investigation of College Astronomy Students Understanding of Spectroscopy
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Learning to Think Like Scientists with the PET Curriculum
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Disseminating the Results of Cognitive Studies through Graduate Teaching Assistant Training
Focusing on Knowledge for Teaching
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Using Clickers in Upper-division Physics Courses: What do Students Think?
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Salience of Representations and Analogies in Physics: How do Students Know What to Know?
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A Longitudinal Study of the Impact of Curriculum on Conceptual Understanding in E&M
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Will a Student Construct a Free-body Diagram to Solve this Problem?
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Constructing Models in Quantum Mechanics
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An Exploration of Student Understanding of the Connection between Particulate Models and Macroscopic Properties of Gases
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Peer-assessment of Homework Using Rubrics
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The Cognitive Structure of Beginning Secondary Physics Teachers' Content Knowledge: A Nature of Physics Construct
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Comparing FCI Normalized Gain, Pre-instruction Scores, and Scientific Reasoning Ability for PER-based and Traditional Lecture Instruction in Introductory Mechanics Classes
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Factors Influencing Student Models of the Lorentz Force on a Charged Particle
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Multiple Modes of Reasoning in Physics Problem-solving, with Implications for Instruction
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Introducing Ill-structured Problems in Physics Recitations
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Analyzing the Force and Motion Conceptual Evaluation using Model Analysis
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Symbols: Weapons of Math Destruction
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Understanding Faculty Use of Peer Instruction
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Comparing Student Use of Mathematical and Physical Vector Representations
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Optimizing Student Learning of Evaluation Abilities
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Ausbeler and Piaget: A Contemporary Investigation
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Using Students’ Design Tasks to Develop Scientific Abilities
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Student Spatial Reasoning and Physics Problem Solving: A Preliminary Study
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Pedagogical Tools to Help Learners Organize Their Ideas
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Assessing Student Expertise in Physics with Isomorphic Problems
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Continued Discussion of the Correlation Coefficient and R2-Value Survey
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Why is Physics Hard?
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An Analysis of Asynchronous Online Homework Discussions in Introductory Physics Courses
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Transfer of Learning in Medical Image Reconstruction: Group Teaching Interviews
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Comparing Student Understanding of Physics and Mathematics in P-V Diagrams
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Student Estimates of Probability and Uncertainty in Advanced Laboratory and Statistical Physics Courses
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Comparing Advanced Undergraduate Reasoning about Entropy across Disciplines
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