



**2010
National
Summer
Conference**

**Integrating Science and Mathematics
Education Research into Teaching**

June 20 to 23, 2010 • University of Maine • Orono, Maine

*Hosted by the Maine Center for Research in STEM Education
at the University of Maine and The Jackson Laboratory*

Maine Center for Research in STEM Education

The University of Maine's Center for Science and Mathematics Education Research was established in 2001 with funding from the U.S. Department of Education to provide an integrated approach to University-based research, teaching and professional development in science and mathematics education. In 2010, the Center became the Maine Center for Research in STEM Education (RiSE) to reflect its expanded mission: To advance the research and practice of teaching and learning in science, technology, engineering and mathematics, the STEM disciplines. This interdisciplinary research center brings together faculty members from the College of Liberal Arts and Sciences, College of Education and Human Development and College of Natural Sciences, Forestry and Agriculture.

The Maine RiSE Center offers the Master of Science in Teaching (MST) program, a content-rich, research-based program with approximately 25 graduate students. The MST program provides a route to initial secondary teaching certification for scientists, engineers and mathematicians, and offers an opportunity for master's level study for practicing science and mathematics teachers and others interested in learning more about research in teaching and learning in their field. MST students are required to conduct a research thesis, and all full-time students are supported by graduate assistantships that provide tuition, partial support for the Graduate School's health insurance plan, and a generous annual stipend.

Please visit our website at <http://www.umaine.edu/center/> to learn more about the Maine RiSE Center, its research, programs and resources for educators. To request additional information about the Master of Science in Teaching Program, please contact Professor Susan McKay at mstinfo@maine.edu or (207) 581-1019.

Acknowledgements of Support

The conference hosts, the Maine Center for Research in STEM Education and The Jackson Laboratory, gratefully acknowledge support from the Howard Hughes Medical Institute; Maine EPSCoR at the University of Maine through National Science Foundation award #0904155; the Provost's Office at the University of Maine; the University of Maine Colleges of Education and Human Development, Engineering, Liberal Arts and Sciences, and Natural Sciences, Forestry, and Agriculture; the School of Biology and Ecology; the Department of Chemistry; and the Department of Physics and Astronomy.

Sunday, June 20, 2010
7:15 PM to 8:15 PM
Wells Conference Center (Rooms 1 & 2)

Keynote Speaker:

Kathleen Roth, Ph.D.
Biological Sciences Curriculum Study
Colorado Springs, Colorado



TIMSS and STeLLA Video Studies of Science Teaching: Integrating Results into Practice

In this session, Dr. Kathleen Roth will use video clips of science teaching to highlight results from two large studies of science teaching: the Trends in International Mathematics and Science Video Study of Eighth-Grade Science Teaching (TIMSS) and the Science Teachers Learning from Lesson Analysis study (STeLLA). The audience will be engaged in analyzing the video clips in order to understand how results from the TIMSS study were used to improve science teaching practice in the STeLLA study.

Kathleen Roth

Kathleen Roth is the director of the Center for Professional Development at the Biological Sciences Curriculum Study (BSCS) in Colorado Springs, CO. Her current research focuses on identifying features of science teacher professional development that improve both teacher and student learning. She is particularly interested in understanding how video-cases of science teaching and learning can support pre-service and in-service teacher learning about science content and pedagogical content knowledge.

Dr. Roth received her Ph.D. in Science Education from Michigan State University, a master's degree in secondary science teaching from Johns Hopkins University, and an undergraduate degree in Biology from Duke University. Her career in education includes seven years as a middle and high school science teacher followed by fifteen years as a teacher educator and researcher at Michigan State University, 10 years as a researcher at, and later Director of LessonLab Research Institute in Santa Monica, CA.

Tuesday, June 22, 2010

7:30 PM to 8:30 PM

Wells Conference Center (Room 1 & 2)



Keynote Speaker:

Joan Ferrini-Mundy, Ph.D.

Acting Assistant Director, Directorate for Education and Human Resources

National Science Foundation

Arlington, Virginia

Progress, Pitfalls, and Possibilities in Integrating STEM Education Research into Teaching

The national need to improve STEM learning is more urgent than ever, and the opportunity for the STEM education research community to have a key role in that improvement at this time may be unique. What are these national needs and priorities, and what are the possible roles for STEM education research? The concept of using educational research to improve instructional practice, particularly in high-priority areas such as science and mathematics, seems obvious. Nonetheless, the path toward enacting this simple idea is not obvious. Following a quick tour of some of the research and theory about the use of educational research in policy and practice, I will describe aspects of this challenge from the perspective of the NSF Directorate for Education and Human Resources. Highlights of successful cases where the theories, conceptual frameworks, tools, instruments, findings, and speculations from educational research have been integrated successfully into teaching will be provided, in mathematics and the sciences, at the K-12 and undergraduate levels. I will explore the meaning of the NSF commitment to the “integration of research and education” in the case where the research is about STEM learning and the education is STEM teaching. And, some challenges and possibilities for both STEM learning researchers and STEM teachers in more effectively achieving this integration in support of improved STEM learning and teaching will be considered.

Joan Ferrini-Mundy

Dr. Joan Ferrini-Mundy is the Acting Assistant Director of the National Science Foundation (NSF) for Education and Human Resources (EHR). In 2009 she served as Acting Executive Officer for the EHR Directorate, and from January 2007 through December 2009 was Director of EHR’s Division of Research on Learning in Formal and Informal Settings (DRL). While at NSF, Dr. Ferrini-Mundy continues to hold appointments at Michigan State University (MSU) as a University Distinguished Professor of Mathematics Education in the Departments of Mathematics and Teacher Education. She served as Associate Dean for Science and Mathematics Education in the College of Natural Science at MSU from 1999-2006. Ferrini-Mundy was a Visiting Scientist in NSF’s Teacher Enhancement Program from 1989-1991, and served as Director of the Mathematical Sciences Education Board and Associate Executive Director of the Center for Science, Mathematics, and Engineering Education at the National Research Council from 1995-1999. She directed the Michigan Department of Education Teacher Preparation Policy Study Group (2006-2007) and chaired the MI Mathematics High School Content Expectations Development Committee. From 1983-1999 Ferrini-Mundy was a member of the Mathematics Department at the University of New Hampshire, and in 1982-1983 she was a mathematics faculty member at Mount Holyoke College, where she co-founded the SummerMath for Teachers Program. She has served on the Board of Directors of the National Council of Teachers of Mathematics (NCTM), chaired the Writing Group for NCTM’s 2000 *Principles and Standards for School Mathematics*, and served on the Board of Governors of the Mathematical Association of America. In 2007-2008, representing NSF, she served as an ex officio member of the President’s National Mathematics Advisory Panel, and co-chaired the Instructional Practices Task Group. Ferrini-Mundy holds a PhD in mathematics education from the University of New Hampshire; her research interests include calculus teaching and learning, the development and assessment of teachers’ mathematical knowledge for teaching, and mathematics and science education policy.

Schedule-at-a-Glance

Sunday, June 20, 2010

Time	Event	Location
4:00 PM – 6:00 PM	Registration	Wells Conference Center (North end pre-function area)
5:00 PM – 6:00 PM	Reception	Wells (Room 1 & 2)
6:00 PM – 7:00 PM	Dinner Banquet	Wells (Room 1 & 2)
7:00 PM – 7:15 PM	Welcoming Remarks Susan Hunter, Ph.D. Senior Vice President for Academic Affairs Provost, University of Maine Orono, Maine	
7:15 PM – 8:15 PM	Opening Keynote Kathleen Roth, Ph.D. Director, Center for Professional Development Biological Sciences Curriculum Study Colorado Springs, Colorado TIMSS and STeLLA Video Studies of Science Teaching: Integrating Results into Practice	Wells (Room 1 & 2)

Monday, June 21, 2010

Time	Event	Location
8:30 AM – 10:30 AM	Registration and Continental Breakfast	Wells (North Pre-Function Area)
9:00 AM – 10:50 AM	Session 1: Strategies in Mathematics Education	Wells (Room 1)
	Session 2: STEM Pipeline	Wells (Room 2)
	Session 3: Mathematics in Science	Wells (Room 3)
10:50 AM – 11:00 AM	Break	
11:00 AM – 12:00 PM	Session 4: Panel Discussion	Wells (Room 2)
	Session 5: Panel Discussion	Wells (Room 3)
12:00 PM – 1:30 PM	Lunch	Memorial Union Marketplace
1:30 PM – 3:30 PM	Workshops	Various Locations – see Pg. 20
3:30 PM – 4:30 PM	Poster Session Set-Up	Wells (Room 1 & 2)
4:30 PM – 6:00 PM	Poster Session Reception (Hors d'oeuvres & Cash Bar)	Wells (Room 1 & 2)
6:00 PM – 8:00 PM	Dinner (on your own)	
8:00 PM – 9:30 PM	Evening Program – Film “Adventures of an Urban Astrophysicist: An Interview of Neil deGrasse Tyson by Thomas Cech”	100 Donald P. Corbett Building

Tuesday, June 22, 2010

Time	Event	Location
8:30 AM – 10:30 AM	Information Table and Continental Breakfast	Wells (North Pre-Function Area)
9:00 AM – 10:50 AM	Session 6: Mathematics	Wells (Room 1)
	Session 7: Physical Science	Wells (Room 2)
	Session 8: Engaging in Science	Wells (Room 3)
10:50 AM – 11:00 AM	Break	
11:00 AM – 12:00 PM	Session 9: Panel Discussion	Wells (Room 2)
	Session 10: Panel Discussion	Wells (Room 3)
12:00 PM – 1:45 PM	Lunch (on your own)	
1:45 PM – 3:45 PM	Workshops	Various Locations – See Pg. 21
4:00 PM – 5:30 PM	Maine STEM Initiative	Wells (Room 3)
5:45 PM – 6:30 PM	Reception	Wells (Room 1)
6:30 PM – 7:30 PM	Dinner Banquet	Wells (Room 1 & 2)
7:30 PM – 8:30 PM	Keynote Joan Ferrini-Mundy, Ph.D. Acting Assistant Director Directorate for Education and Human Resources National Science Foundation Progress, Pitfalls, and Possibilities in Integrating STEM Education Research into Teaching	Wells (Room 1 & 2)

Wednesday, June 23, 2010

Time	Event	Location
8:30 AM – 10:30 AM	Information Table and Continental Breakfast	Wells (North Pre-function area)
9:00 AM – 9:45 AM	Session 11: Mathematics	Wells (Room 1)
	Session 12: Engineering	Wells (Room 2)
	Session 13: Physical Science	Wells (Room 3)
9:45 AM – 10:15 AM	Break	
10:15 AM – 12:00 PM	Open Space Session	Wells (Room 1)
	Open Space Break-Out Conversations	Wells (Room 1, 2, & 3)
	Open Space Reports and Conference Wrap-Up	Wells (Room 1)
	Lunch Turn in Evaluation	Memorial Union Marketplace

Detailed Presentation Schedule

Monday, June 21st · Overview of Morning Sessions

Session Title	(S1) Strategies in Mathematics Education	(S2) STEM Pipeline	(S3) Mathematics in Science
Chair	Mitchell Bruce	Karen Horton	John Thompson
Location	Wells Room 1	Wells Room 2	Wells Room 3
9:00-9:45 AM	Making Math Work: Building Academic Skills in an Occupational Context <i>James R. Stone III</i>	STEM Education Programs for the 21st Century Workforce <i>Clifford Houston</i>	Transfer of Learning from Mathematics to Physics <i>N. Sanjay Rebello</i>
9:45-10:30 AM	Closer to Fair: Teaching Mathematics for Social Justice <i>David Kung</i>	Communities for Rural Education, Stewardship, and Technology (CREST): Successful Methodologies for STEM Implementation and Influencing Teacher Practice <i>Ruth Kermish-Allen</i>	Making Sense of Observation and Data (Graphs are Not Just for Math Class): Integrating Explicit Instruction in Working with Data into Science Education <i>Bill Zoellick W. Tad Johnston</i>
10:30–10:50 AM	Enriching Mathematical Instruction by Introducing Real Life Applications from Physics <i>Zenobia Lojewska Fides Ushe</i>	Development of Pedagogical Insights and Strategies to Overcome Barriers to Women in STEM <i>Abby Ilumoka-Nwabuzor</i>	Graphing in Science Class <i>Thomas Wemyss</i>
10:50-11:00 AM	BREAK		
Moderator	Jeff St. John	Susan McKay	
Location	Wells Room 2	Wells Room 3	
Panels 11:00 AM-12:00 PM	(S4) Teachers Working with Scientists, Non-Profits, and Other Agencies <i>Jo Shanklin, Ed Lindsey, Jennifer Briggs, Deb McGann, Tracy Vassiliev, John Mannette, Jennifer Shanholtzer</i>	(S5) K-12 Principles of Engineering Design <i>Dan Queior, David Dorr, Anita Bernhardt, Paul Wlodkowski</i>	

Tuesday, June 22nd · Overview of Morning Sessions

Session Title	(S6) Mathematics	(S7) Physical Science	(S8) Engaging in Science
Chair	Chris Gerbi	Brian Frank	Thomas Wemyss
Location	Wells Room 1	Wells Room 2	Wells Room 3
9:00-9:45 AM	<p>Lessons Learned from Analyses of Mathematics Textbooks</p> <p><i>Vilma Mesa</i></p>	<p>Table-top Earth Analogs: Energy Transfer through Systems for 9th Graders, an Investigation of a Core Concept by a Six-School Collaborative</p> <p><i>Ed Lindsey, Ben Ewing, Michael Morton, Lisa Schultz</i></p>	<p>Engaging Students in Inquiry through a Backwards Faded Scaffolding Approach</p> <p><i>Timothy Slater</i></p>
9:45-10:30 AM	<p>Creating Representations of Mathematical Work and Using Them to Study Teaching</p> <p><i>Patricio Herbst</i></p>	<p>What Can Be Learned from Laboratory Activities?</p> <p><i>Michael R. Abraham</i></p>	<p>Impact of Summer Undergraduate Research Experiences on Top-Tier Female Scientists</p> <p><i>Stephanie Slater</i></p>
10:30-10:50 AM	<p>Student Misconceptions of the Language of Calculus: Definite and Indefinite Integrals</p> <p><i>William L. Hall, Jr.</i></p>	<p>Research on Student Model Formation and Development in Physics</p> <p><i>Mark Lattery</i></p>	<p>Introducing Science Fiction and Nonfiction Into Your Classroom</p> <p><i>Tracy Vassiliev Patricia Bernhardt</i></p>
10:50-11:00 AM	BREAK		
Moderator	Molly Schaufler	Susan McKay	
Location	Wells Room 2	Wells Room 3	
<p>Panels 11:00 AM-12:00 PM</p>	<p>(S9) Implementing Guided-Inquiry in Middle and High School Classrooms</p> <p><i>Lauree Gott, Jim Fratini, Sue Klemmer, W. Tad Johnston</i></p>	<p>(S10) Strategies to Build the STEM Pipeline</p> <p><i>Susie Valaitis, Patricia Bernhardt, Abby Ilumoka-Nwabuzor, Lucille Zeph</i></p>	

Wednesday, June 23rd · Overview of Morning Sessions

Session Title	(S11) Mathematics	(S12) Engineering	(S13) Physical Science
Chair	Francois Amar	Paul Wlodkowski	Michael Wittmann
Location	Wells Room 1	Wells Room 2	Wells Room 3
9:00-9:45 AM	<p>Teachers' Use of Pedagogical and Specialized Content Knowledge in College Mathematics Classes</p> <p style="text-align: center;"><i>Natasha Speer</i></p>	<p>Building Math -Do Math and Science Inform the Engineering Designs?</p> <p style="text-align: center;"><i>Peter Y. Wong</i></p>	<p>Using the PER User's Guide and Adopting/Adapting Course Materials</p> <p style="text-align: center;"><i>Sarah "Sam" McKagan</i></p>
9:45-10:15 AM	Break		
10:15 AM-12:00	OPEN SPACE SESSION		
	Facilitators: Susan McKay and Natasha Speer		
	Location: Wells (Room 1)		
	Open Space Break-Out Conversations		
	Location: Wells (Room 1, 2, & 3)		
	Open Space Reports and Conference Wrap Up		
	Location: Wells (Room 1)		
Turn in Evaluation			
Lunch in Memorial Union Marketplace			

Monday Afternoon Workshops (1:30 pm - 3:30pm)

***NOTE:** Although workshops do not require pre-registration, we request that you sign up for Monday and Tuesday afternoon workshops at the registration desk when picking up your registration material.

Workshop Title	Facilitator	Building & Rm.
W1: Building Academic Skills in an Occupational Context	<i>James R. Stone III</i> University of Louisville	105 Donald P. Corbett Bldg.
W2: Re*Sci*cling Enhances STEM Learning	<i>Charles Griffin and David Harmon</i> IBM Systems & Technology	109 Donald P. Corbett Bldg
W3: Dragons as a Model Organism for Inquiry in Computational Biology	<i>Randy Von Smith</i> The Jackson Laboratory	117 Donald P. Corbett Bldg.
W4: An Engineering Approach involving Rocket Design as a Learning Tool to Understanding Newton's Second Law	<i>Paul Wlodkowski</i> Maine Maritime Academy	Rogers 206
W5: Building Educator-Scientist Partnerships through Digital Concept Mapping	<i>Medea Steinman</i> <i>Artur Palacz</i> <i>Carrie Armbrecht</i> University of Maine	Little 211
W6: Better than Being There: Video of Student Collaborative Workgroups as a Tool for Professional Development	<i>Michael C. Wittmann</i> <i>Jeffrey Hawkins</i> University of Maine	Barrows 119
W7: Closer to Fair: Social Justice in Mathematics - Mathematics for Social Justice	<i>David Kung</i> St. Mary's College of Maryland	Little 203
W8: Dancing With the Stars: Teaching Seasons and Moon Phases Using Kinesthetic Learning	<i>Stephanie J. Slater</i> University of Wyoming	Barrows 125
W9: Tree Data, Tree Brochures and Composites	<i>Elizabeth Haynes</i> <i>Kelley Littlefield</i> Troy A. Howard Middle School	Barrows 133
W10: Approaches to Promote Graphing in Literacy in Science Class	<i>John R. Thompson</i> <i>Thomas Wemyss</i> University of Maine	Barrows 123

Tuesday Afternoon Workshops I (1:45 PM - 3:45PM)

Workshop Title	Facilitator	Building & Rm #
W11: Growing College Readiness with a "Take Math" Culture	<i>Wendy Ault</i> <i>Pamela Ford-Taylor</i> <i>Robert Franzosa</i> <i>Marlene Lauritsen</i> <i>Christine LeGore</i> <i>Margaret Moore</i> <i>Tom Quick</i> <i>Sue Simoneau</i> MELMAC Education Foundation	107 Donald P. Corbett Bldg.
W12: Improving Teaching and Learning by Conducting Education Research in Your Classroom	<i>Timothy Slater</i> University of Wyoming	Little 211
W13: What is in a Problem, Apropos of the Angle Bisectors of a Quadrilateral?	<i>Patricio Herbst</i> University of Michigan	113 Donald P. Corbett Bldg.
W14: Better than Being There: Video of Student Collaborative Workgroups as a Tool for Professional Development	<i>Michael Wittmann</i> <i>Jeffrey Hawkins</i> University of Maine	Barrows 119
W15: Making Sense of Data: An Introduction	<i>Bill Zoellick</i> Acadia Partners for Science and Learning <i>W. Tad Johnston</i> William S. Cohen Middle School	DPC 109
W16: Building Math – Hands-On Design Challenges	<i>Peter Wong</i> Boston Museum of Science	Rogers 206
W17: Molecular Level Laboratory Experiments Using Computer Simulations	<i>Michael Abraham</i> University of Oklahoma	Barrows 124
W18: Table-top Earth Analogs: Energy Transfer through Systems for 9th Graders, an Investigation of a Core Concept by a Six-School Collaborative	<i>Ed Lindsey</i> <i>Lisa Schultz</i> Old Town High School <i>Ben Ewing</i> Bucksport High School <i>Michael Morton</i> Brewer High School	Bennett 315
W19: Embodied Learning Activities: Using Bodily Experiences to Build and Share Understanding of Abstract Science Concepts	<i>Sarah McKagan</i> American Association of Physics Teachers	Barrows 125
W20: The Maine STEM Initiative: Building Partnerships & Strategies SPECIAL TIME: 4:00 PM – 5:30 PM	<i>Susan R. McKay</i> University of Maine	Wells Rm. 3

Open Space

**Susan R. McKay, Professor of Physics and Director
of the Maine Center for Research in STEM Education**
**Natasha Speer, Assistant Professor of Mathematics Education
and member of the Maine Center for Research in STEM Education**
University of Maine

Question: How can we use what we have learned at this conference to collaborate to improve STEM education?

Open Space is simple, self-directed, and focused. Participants will create the agendas for simultaneous break-out sessions. After the sessions are complete, we will gather for a follow-up discussion.

Open Space is designed for participants to seize the moment, to begin a conversation that combines imagination and practicality, and that leads to unique ideas to answer the question.

Participants present ideas for which they have a passion and are willing to take responsibility for convening a conversation. Conveners ask someone in the group to write a summary of the key points discussed to be shared with the larger group. Together, as a larger group, we will formalize some of the best conversations of the break-out sessions.

The Law of Two Feet:

If participants are not learning or contributing they must use their two feet to join another discussion; all are responsible for their participation. Open Space works if people care about the issue, the issue is complex, there is a sense of urgency, and people represent diverse points of view.

The bumblebees buzz from group to group, cross-pollinating ideas. Butterflies don't participate in formal sessions but stimulate informal discussions.

We hope the Open Space break-out conversations will lead to:

1. *High learning:* Participants change how they think, enabling them to create new ideas & linkages.
2. *High play:* A convivial, open atmosphere is developed where participants can question dogma.
3. *Formation of a genuine community:* Participants develop deeper bonds with their peers and expand their networks by talking with people they don't know but who share their passion.
4. *Tangible output:* Participants generate worthwhile ideas (as measured by group consensus), express them clearly in reports, and create plans to move these ideas forward.

This discussion session will follow the guidelines at <http://www.openspaceworld.com>

The Maine STEM Initiative - Building Partnerships and Strategies

**Susan R. McKay, Professor of Physics and Director, Maine Center for Research in STEM
Education, University of Maine**

This session will bring together business leaders, science, technology, engineering, and mathematics (STEM) educators, and non-profit leaders to discuss ways to broaden participation and strengthen achievement by Maine students in STEM fields. Participants will hear an update on progress since the STEM summit held in January and will have a chance to summarize their organizations' priorities, partnerships, and projects in this area. There will also be an opportunity for participants to display posters to teach others about their work. After brief introductory remarks, this session will focus on fostering partnerships and strategies for meeting our common goals.

Information

For information or assistance call:

Rob Blaisdell (Transportation): (207) 949-0429
Leisa (Conference & Local Information): (207) 974-8753
Amie (Conference Information): (207) 949-1449

Wireless Internet Access ~ Guest Pass for Summer Conference Attendees ~ 2010

IMPORTANT: The University of Maine takes copyright violations seriously. We request that you disable all file sharing programs, e.g. Limewire, BitTorrent, eDonkey, etc. while on our network. Most file sharing programs run in the background and must be manually disabled.

If you experience any issues with your connection or need assistance disabling your file sharing, you may go to 17 Shibles Hall (basement) or contact our IT Help Center at 581-2506 during the hours of:
8 am – 5 pm on Monday – Friday

If using a PC, go to wireless icon in lower right corner and choose “view available wireless networks” and select “UMS-Guest”.

If using a MAC, click on wireless access icon in upper right corner and select “UMS-Guest”.
Open browser. Firefox works best as a first choice.

You will be given a page that asks for your email address. Enter your email address and click Accept. The system will now allow you to get online.

After hours connectivity problems:

PC: right-click on the network icon on the lower right corner and select "diagnose and repair." The computer should then offer options to help fix the connection.

MAC: click on wireless access icon in upper right corner. Select “tempest” then turn off the “airport” then turn it back on.

There is wireless access in all classroom buildings and most public areas on campus.