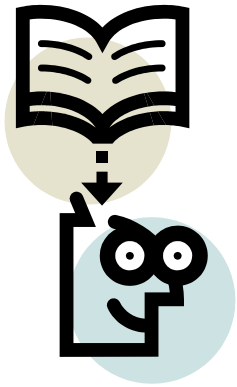
2002 National Summer Conference "Integrating Science and Mathematics Education Research into Teaching"

June 23 to 25, 2002 • The University of Maine • Orono, Maine

Sponsored by
The University of Maine Center for Science and Mathematics Education Research
Maine Mathematics and Science Teaching Excellence Collaborative



http://perlnet.umephy.maine.edu/center/2002announce.htm

Program Contents

Center for Science and Mathematics Education Research

The Center for Science and Mathematics Education Research on The University of Maine campus in Orono integrates research in student learning, research in teacher beliefs, and assessment of curricula into University-based research and training in science and mathematics education. The main objectives of the Center are to

- rebuild introductory courses in mathematics and the sciences based on math-, chemistry-, earth science-, and physics-centered education research
- create attractive, content-rich teacher preparation and continuing education options for mathematics and science teachers that integrate content and pedagogy
- spearhead partnerships with public school teachers and University faculty to understand how student interest and achievement in mathematics and science are enhanced
- develop materials to form the basis for a statewide or national curriculum based on cultivating mathematics and science thinking through inquiry models.

The Center aims to become a source of well-qualified science and mathematics teachers for grades K–12 as well as a leader in creating coherent, developmentally-appropriate curricula for mathematics and science for grades 6–16.

This project is funded by the U.S. Department of Education Fund for the Improvement of Education Award Number R125K010106.

Maine Mathematics and Science Teaching Excellence Collaborative

This project is a collaborative effort among three campuses of the University of Maine System and the Maine Mathematics and Science Alliance; the three campuses are University of Maine at Farmington, University of Maine at Orono, and University of Southern Maine. The main purposes of the project are to

- increase the number of qualified teachers of mathematics and science (6-12) in the state of Maine
- improve the quality of the teacher education programs at each of the three campuses by bringing together faculty from the colleges of education, faculty from the colleges of arts and sciences, students in the different programs, and K-12 in-service teachers in mathematics and science to work collaboratively toward these goals.

Teacher preparation is the responsibility of faculties of both colleges of arts and sciences and colleges of education. Only through the integration of correct content and effective pedagogy can we provide the best education to K-16 children.

This project is funded by the National Science Foundation's Division of Undergraduate Education Collaboratives for Excellence in Teacher Preparation (CETP) program award number 9987444

Keynote Addresses

Sunday, June 23, 2002
7:00 PM to 7:45 PM
Wells Main Dining Facility

"Our Model of How a Student 'Works': Does it matter for teaching science?"

E.F. "Joe" Redish
Department of Physics, University of Maryland
redish@physics.umd.edu

Teachers of science usually talk about how the world works, but rarely about how their students work (or don't work) – except to complain. But our model of thinking and learning plays a critical role in our teaching, whether we are aware of it or not. This talk will give a primer on a cognitive model of thinking and learning relevant for teaching science.

Tuesday, June 25, 2002
6:45 PM to 7:30 PM
Wells Main Dining Facility

"The Top Ten Problems with Teaching and Learning the Natural Sciences"

Gordon Uno
Department of Botany and Microbiology, Oklahoma University
guno@ou.edu

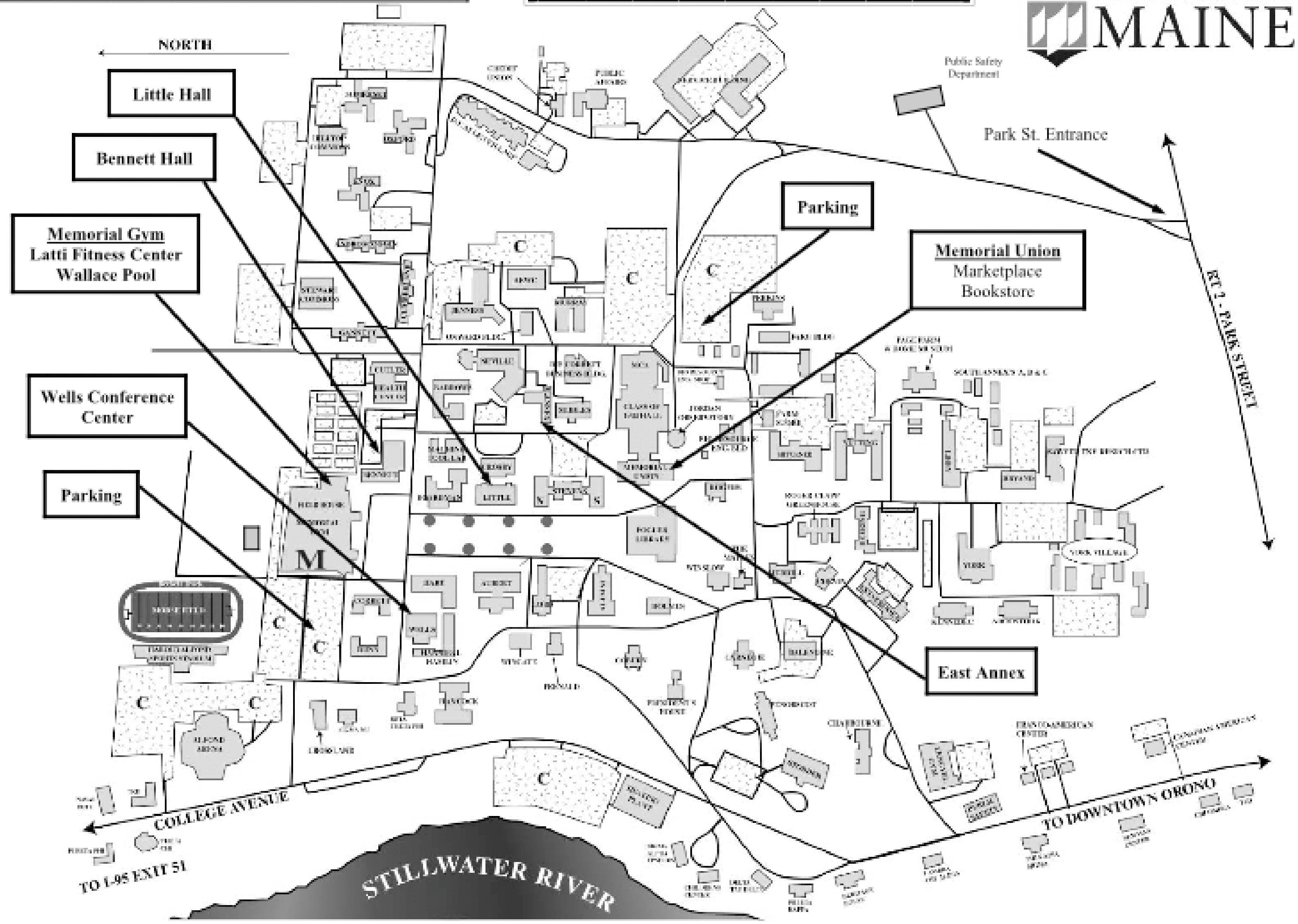
The successful education of students in college and pre-college science classrooms requires attention to problems associated with: (1) the instructors of science courses; (2) the students in those courses; and (3) the courses themselves. Ten major problems with teaching and learning science have been identified that are associated with all three of these areas. These problems are applicable to courses, students, and instructors at both the high school and college levels. The problems and their potential solutions will be reviewed.

PARKING NOTICE:
Conference participants and visitors must park by permit and use Resident (R) or Commuter (C) parking lots only. Permits may be obtained from Conference Services, the Visitors' Center or the Public Safety Office.

<u>**NOTE**</u>: Cars illegally parked in handicapped spaces, fire lanes and on the grass will be fined and be towed immediately.

Integrating Science and Mathematics Education Research into Teaching
June 23 ~ 25, 2002

University Operators: 581-1110
Connecting all departments until 4:30 PM
Public Safety: 581-4040
Emergency Only: 911



Campus Map

The map on the previous page serves to supplement the campus map distributed at registration. It highlights buildings used by the conference as well as other facilities of interest to participants on campus. Please excuse the small font size and general fuzziness.

Driving Directions to The University of Maine Campus in Orono

From the South Exit 50:

- Coming from the south on I-95, take Kelley Road Exit (#50).
- Turn right at end of exit ramp. Drive 1 mile to the red flashing light.
- Take left onto Route 2. Drive 2.5 miles to the third set of traffic lights
- Turn left onto College Avenue.
- Take the right onto Munson Road at the University of Maine sign.

From the South Exit 51:

- Exit (#51) - Stillwater Avenue/Old Town - I-95 (either north - or south-bound.)
- Turn towards Burger King and the shopping center.
- Turn right at the fourth traffic light by McDonald's and KFC and go down College Avenue.
- Take the third left onto Munson Road at the first University of Maine sign.

From the North Exit 51:

- Coming from the north on I-95, take Stillwater Avenue Exit (#51).
- Turn left at the end of the exit ramp.
- Drive 1 mile to the fourth set of traffic lights.
- Turn right onto College Avenue
- Take the third left onto Munson Road at the first University of Maine sign.

Schedule-at-a-Glance

Sunday, June 23, 2002

4:00 PM – 8:00 PM	Registration	Wells Commons Lobby
5:00 PM – 6:00 PM	Poster Session 1 Set-up	Wells Main Dining Facility
6:00 PM – 7:00 PM	Banquet and Cash Bar	Wells Main Dining Facility
7:00 PM – 7:45 PM	Opening Comments Keynote Address: "Our Model of How a Student 'Works': Does it matter for teaching science?" E.F. "Joe" Redish	Wells Main Dining Facility
7:50 PM – 9:00 PM	Poster Session 1	Wells Main Dining Facility

Monday, June 24, 2002

8:00 AM – 1:30 PM	Registration	Wells Commons Lobby
8:00 AM – 10:30 AM	Coffee, Danish, and Bagels	Little Hall Lobby
9:00 AM – 11:00 AM	Session 1 "Teacher Preparation and Professional Development I"	110 Little Hall
	Session 2 "Research into Student Learning I"	120 Little Hall
	Session 3 "Research-based Curriculum Innovation and Curriculum Assessment (Post-Secondary)"	130 Little Hall
	Session 4 "Research-based Curriculum Innovation and Curriculum Assessment (Middle and Secondary)"	140 Little Hall
11:10 AM – 11:55 AM	Panel Discussion 1 "Strategies for Enhancing Participation by Under-represented Groups in Science and Mathematics"	120 Little Hall
	Panel Discussion 2 "Preparing Tomorrow's Teachers to Meet the Demands of the Pedagogically-rich Science and Mathematics Classroom"	130 Little Hall
12:00 PM – 1:30 PM	Lunch "Wrap" Buffet	Wells Main Dining Facility
1:30 PM – 3:30 PM	Workshop 1 "Developing and Assessing Inquiry-Based Materials for Teacher Education" *Jacqueline Huntoon, Michigan Technical University*	110 Little Hall
	Workshop 2 "Non-Traditional Ways of Assessing Chemistry Learning" *William Robinson, Purdue University*	120 Little Hall
	Workshop 3 "Cooperative Group Problem Solving" *Ken and Patricia Heller, University of Minnesota*	130 Little Hall
	Workshop 4 "With Microscopes and Moccasins: American Indian success in math and science" *Maureen Smith, The University of Maine*	140 Little Hall
	Workshop 5 "Programming as a Powerful Tool for Learning" *Larry Latour, The University of Maine*	224 East Annex
3:30 PM – 5:00 PM	Break	
4:00 PM – 5:00 PM	Poster Session 1 Take-down; Poster Session 2 Set-up	Wells Main Dining Facility
5:00 PM – 6:30 PM	Poster Session 2 with Pre-Dinner reception and Cash Bar	Wells Main Dining Facility
6:30 PM –	Dinner on your own	

Tuesday, June 25, 2002

8:00 AM – 11:00 PM	Registration	Little Hall Lobby
8:00 AM – 10:30 AM	Coffee, Danish, and Bagels	Little Hall Lobby
9:00 AM – 11:00 AM	Session 5 "Teacher Preparation and Professional Development" II	110 Little Hall
	Session 6 "Research into Student Learning" II	120 Little Hall
	Session 7 "Research-based Curriculum Innovation and Assessment" III	130 Little Hall
	Session 8 "Methods of Conducting Research into Student Learning"	140 Little Hall
11:10 AM – 11:55 AM	Panel Discussion 3 "Research into Learning: How It Will Change the Classroom of the Future"	120 Little Hall
	Panel Discussion 4 "The Impact of Technology on Science and Mathematics Pedagogy and Practice"	130 Little Hall
12:00 PM – 1:30 PM	Lunch on your own	
1:30 PM – 3:30 PM	Workshop 6 "Lecture-Free Teaching In College Science Courses" *Bonnie Wood, University of Maine, Presque Isle*	110 Little Hall
	Workshop 7 "Analyzing Qualitative Data " *Patrick Thompson, Vanderbilt University*	120 Little Hall
	Workshop 8 "Workshop on Guided-inquiry Instruction in Chemistry" *James Spencer, Franklin and Marshall College*	130 Little Hall
	Workshop 9 "Studio Calc/Phys: The challenges in creating an interdisciplinary course" *Dawn Meredith, University of New Hampshire*	140 Little Hall
3:30 PM – 5:30 PM	Break	
5:30 PM – 6:45 PM	Lobster Banquet	Wells Main Dining Facility
6:45 PM – 7:30 PM	Keynote Address: "Top Ten Problems with Teaching and Learning the Natural Sciences" *Gordon Uno, Oklahoma University*	Wells Main Dining Facility
7:30 PM – 8:00 PM	Closing Comments; Transition to MMSTEC Summer Academy	Wells Main Dining Facility

Monday, June 24th • Morning Session Overview

	(S1) Teacher Preparation and Professional Development I	(S2) Research into Student Learning I	(S3) Research-based Curriculum Innovation and Curriculum Assessment (Post-Secondary)	(S4) Research-based Curriculum Innovation and Curriculum Assessment (Middle and Secondary)
	110 Little Hall	***120 Little Hall***	***130 Little Hall***	***140 Little Hall***
9:00 AM	"Using Earth System Science Content as a Framework for In-service and Pre-service Teacher Training" (p. 14) *Jacqueline Huntoon*	"A Model of the Science Learner" (p. 15) *Bill Robinson*	"Do Students Learn More from Some Demonstrations Than Others?" (p. 17) *Adam Fagan*	"Reforming Middle School Physical Science: Building a curriculum from the ground up" (p. 19) *Patricia Heller*
9:15 AM			"What Happens When You Change Everything at Once?" (p. 17) *Tevian Dray*	
9:30 AM	"An Analysis of Pre-service Secondary Mathematics Teachers' Knowledge, Beliefs, Goals, and Behaviors: Implications for recruitment, preparation, and retention" (p. 14) *Frances Curcio & Alice Artzt*	"Identifying and Addressing Student Difficulties with Two-dimensional Kinematics" (p. 16) *John Thompson*	"Redesign of Introductory Biology at the University of Massachusetts: Assessment of improvement in student learning and problem solving skills" (p. 17) *Steve Goodwin*	"CIPS - A Middle School Physical Science Curriculum: Challenges in promoting student learning and teacher implementation" (p. 19) *April Maskiewisc*
9:45 AM				
10:00 AM	BREAK	BREAK	BREAK	BREAK
10:15 AM	"What Impact Do Reform-based Practices Actually Have on Future Teachers?" (p. 15) *Michael Jabot*	"Issues at the Intersection of Science and Culture: Lessons learned from teaching the Earth sciences in Southern California Native American communities" (p. 16) *Eric Riggs*	"Teaching Introductory Physics Through Problem Solving: "I understand the material, I just can't solve the problems" (p. 18) *Ken Heller*	"Application of Computer-aided Mathematics Teaching in a Secondary School" (p. 19) *M. Emin Yenitepe*
10:30 AM	"A Course in Physics Education Research for Teachers" (p. 15) *Michael Wittmann*			"Investigating Linear and Exponential Reasoning of Students in a Reformed College Algebra Course" (p. 20) *Eric Pandiscio*
10:45 AM			"Geometric Visualization as the Bridge between Abstract Mathematics and Scientific Applications" (p. 18) *Tevian Dray*	"Seeing with Light: Spectroscopy in the high school chemistry class" (p. 20) *Michele Benoit*

Monday Panel Discussions

Panel Discussions (P1) – (P2)
Monday, June 24, 2002
11:10 AM to 11:55 AM

P1 "Strategies for Enhancing Participation by Under-represented Groups in Science and Mathematics"
120 Little Hall
Moderator: Ann Schonberger

Panelists: Elizabeth Allen, College of Education and Human Development, The University of Maine
Leonard Kass, Department of Biology, The University of Maine
Eric Riggs, Department of Geological Sciences, San Diego State University
Bonnie Wood, Department of Biology, University of Maine at Presque Isle

P2 "Preparing Tomorrow's Teachers to Meet the Demands of the Pedagogically-rich Science and Mathematics Classroom"
130 Little Hall
Moderator: Stephen Kaback

Panelists: Alice Artzt, Department of Secondary Education and Youth Services, Queens College of CUNY
Frances Curcio, Department of Secondary Education and Youth Services, Queens College of CUNY
Patricia Heller, Department of Curriculum and Instruction, University of Minnesota
Jacqueline Huntoon, Department of Geological Engineering and Sciences, Michigan Technical University
Gordon Uno, Department of Botany and Microbiology, Oklahoma University

Monday Afternoon Workshops

Workshops (W1) – (W5)
Monday, June 24, 2002
1:30 PM to 3:30 PM

NOTE: Although workshops do not require pre-registration, we request that you sign up for Monday and Tuesday afternoon workshops at the registration desk (Wells Lobby) when picking up your registration material. Sign up sheets are attached to conference bulletin boards.

(W1)	(W2)	(W3)	(W4)	(W5)
110 Little Hall	***120 Little Hall***	***130 Little Hall***	***140 Little Hall***	***224 East Annex***
"Developing and Assessing Inquiry-based Materials for Teacher Education" (p. 28)	"Non-traditional Ways of Assessing Chemistry Learning" (p. 28)	"Cooperative Group Problem Solving?" (p. 28)	"With Microscopes and Moccasins: American Indian success in math and science" (p. 29)	"Programming as a Powerful Tool for Learning" (p. 29)
Jacqueline Huntoon	*William R. Robinson*	*Ken & Patricia Heller*	*Maureen Smith*	*Larry Latour*

This workshop limited to 20 participants

Tuesday, June 25th • Morning Session Overview

	(S5) Teacher Preparation and Professional Development II	(S6) Research into Student Learning II	(S7) Research-based Curriculum Innovation and Curriculum Assessment III	(S8) Methods of Conducting Research into Student Learning
	110 Little Hall	*120 Little Hall*	*130 Little Hall*	*140 Little Hall*
9:00 AM	"Process and Inquiry in the Earth Sciences: Research into the design of active, inquiry-based content courses for pre-service and in-service elementary teachers" (p. 21) *Eric Riggs*	"Developing Student Expectations in Algebra-based Physics" (p. 22) *E.F. "Joe" Redish*	"Lecture-free Teaching in College Science Courses" (p. 24) *Bonnie Wood*	"Impact of Peer-Led Team Learning (PLTL) in a PER-Materials-Based Introductory Course" (p. 25) *David Batuski*
9:15 AM				BREAK
9:30 AM	"Effectiveness of Student Investigations in High School Science" (p. 21) *Mark Miksic*	"Programming as a Powerful Tool for Learning" (p. 22) *Larry Latour*	"Getting Serious About Thinking in College General Chemistry" (p. 24) *Chris Bauer*	"A Framework for Making Sense of Interviews and Observations" (p. 25) *Patrick Thompson*
9:45 AM		"From Bouncing Balls to Kinetic Theory: Model-based reasoning as an emergent process" (p. 23) *Nicole Gillespie*		
10:00 AM	BREAK	"Setting the Stage: Task choice for rich mathematical discussion in differential equations" (p. 23) *Karen King*	"New Directions in Teaching Chemistry" (p. 24) *James Spencer*	"Using Individual Student Interviews to Understand Student Models of Current Flow" (p. 26) *Rachel Scherr*
10:15 AM				BREAK
10:30 AM	"Second Teaching: Small groups act as mentors in science learning" (p. 22) *Lisa Novemsky*	"A Methodology for Investigating Students' Understanding of Mathematical Concepts" (p. 23) *John Donovan*	"Studio Calc/Phys: Combining calculus, physics, and active learning" (p. 25) *Dawn Meredith*	"Science Literacy: What it is and why there isn't more of it" (p. 26) *Gordon Uno*
10:45 AM				

Tuesday Panel Discussions

Panel Discussions (P3) – (P4)
Tuesday, June 25, 2002
11:10 AM to 11:55 AM

P3 "Research into Learning: How It Will Change the Classroom of the Future"
120 Little Hall
Moderator: Michael Wittmann

Panelists: E. F. "Joe" Redish, Department of Physics, University of Maryland
William Robinson, Department of Chemistry, Purdue University
James Spencer, Department of Chemistry, Franklin and Marshall College
Patrick Thompson, Department of Mathematics, Vanderbilt University

P4 "The Impact of Technology on Science and Mathematics Pedagogy and Practice"
130 Little Hall
Moderator: Tom Bickford

Panelists: Ken Heller, Department of Physics, University of Minnesota
Stephen Kaback, Center for Science and Mathematics Education Research, The University of Maine
Leonard Kass, Department of Biology, The University of Maine
George Markowsky, Department of Computer Science & Department of Mathematics

Tuesday Afternoon Workshops

Workshops (W6) – (W9)
Tuesday, June 25, 2002
1:30 PM to 3:30 PM

NOTE: Although workshops do not require pre-registration, we request that you sign up for Monday and Tuesday afternoon workshops at the registration desk (Wells Lobby) when picking up your registration material. Sign up sheets are attached to conference bulletin boards.

(W6)	(W7)	(W8)	(W9)
110 Little Hall	***120 Little Hall***	***130 Little Hall***	***140 Little Hall***
"Lecture-Free Teaching In College Science Courses" (p. 29) *Bonnie Wood*	"Analyzing Qualitative Data" (p. 30) *Patrick Thompson*	"Workshop on Guided-inquiry Instruction in Chemistry" (p. 30) *James Spencer*	"Studio Calc/Phys: The challenges in creating an interdisciplinary course" (p. 30) *Dawn Meredith*

Session Abstracts

Session 1 (S1): Teacher Preparation and Professional Development I
Monday, June 24, 2002 – 9:00 AM to 10:45 AM
110 Little Hall
Presider: Jeffrey Owen

9:00 AM

S1-1 Invited Talk "Using Earth System Science Content as a Framework for In-service and Pre-service Teacher Training"

Jacqueline E. Huntoon & Gregg J.S. Bluth
Department of Geological Engineering and Sciences, Michigan Technological University
jeh@mtu.edu & gbluth@mtu.edu

Michigan Technological University's Department of Geological Engineering and Sciences offers an introductory-level, field-based, earth-system science course that is taught in the National Parks and Monuments of Utah and is designed to meet the needs of pre-service and in-service teachers, as well as university undergraduates who may have an interest in teaching. The course was developed to achieve four main goals: 1) increase content area knowledge among practicing earth science teachers, 2) increase awareness of innovative pedagogical methods that can be successfully applied in earth science instruction at the K-12 level among practicing and pre-service teachers, 3) increase the level of interest and enthusiasm for earth science in particular (and science in general) among K-12 teachers, and 4) increase the number and diversity of university undergraduates who pursue careers in earth science education. A mixture of practicing teachers, pre-service teachers, and university undergraduates is targeted because practicing teachers can learn about basic earth science concepts from university undergraduates, pre-service teachers can benefit from interaction with practicing teachers, and non-pre-service university undergraduates can be exposed to the concept of teaching as a possible career by working alongside practicing and future teachers.

The course was developed based on the premise that science is most exciting to both teachers and students when it is used to answer questions. Traditional instructional practices emphasize the need to learn a great deal *about* science (for example, by memorizing jargon or formulas) before actually *participating* in scientific inquiry. Current pedagogical research consistently demonstrates the importance of inquiry-based learning. Unfortunately, however, transforming a classroom from traditional instruction to inquiry-based instruction requires teachers to teach in ways that differ significantly from how they themselves were taught. Many practicing teachers are not immediately prepared to make such a transition due to lack of time, lack of exposure to new teaching methods with high potential for success, or lack of in-depth content area knowledge. These hindrances to change are particularly significant for earth science teachers because many are teaching out of their major or minor content area discipline, and the course described here is intended to help teachers overcome obstacles to change.

Participants' performance in the course is monitored through the use of diagnostic learning logs (self-assessment) and through instructor evaluations of written and verbal material. The course's effectiveness at meeting its goals is determined through the use of pre-course and post-course instruments that include attitudinal surveys, lower-order content knowledge evaluations, and higher-order thinking skills evaluations.

9:30 AM

S1-2 Invited Talk "An Analysis of Pre-service Secondary Mathematics Teachers' Knowledge, Beliefs, Goals, and Behaviors: Implications for recruitment, preparation, and retention"

Frances Curcio & Alice Artzt
Department of Secondary Education and Youth Services, Queens College of CUNY
Frances_Curcio@qc.edu & qcartzt@aol.com

The purpose of this paper is to describe an investigation of pre-service teachers' knowledge, beliefs, and goals and how these factors contribute to their development as mathematics teachers from when they first decided to enter the program as college freshmen to when they begin student teaching in their senior year. This will be done by

(1) presenting samples of longitudinal qualitative data on pre-service secondary mathematics teachers in the first cohort of the TIME 2000 Project (i.e., data from 1998 to 2001) that describe their development with respect to knowledge, beliefs, goals, and behaviors; (2) describing characteristics and emerging patterns revealed in the data and related validity issues; and (3) discussing the implications and value of such research on recruitment, preparation, and retention of prospective secondary mathematics teachers.

10:00 AM BREAK

10:15 AM

S1-3 "What Impact Do Reform-based Practices Actually Have on Future Teachers?"

Michael Jabot
State University of New York at Fredonia
mjabot@ureach.com

This presentation will report on the preliminary results of a misconceptions-based approach to the teaching of elementary science methods. The impact that a reform-based treatment of physics content has on both the development of the pre-service teachers content knowledge as well as the development of efficacy toward the teaching of science in these future teachers will be reported. Of particular note, are the initial findings, which imply that the impact of the reform-based on conceptual development may ultimately be limited by the pre-service teachers prior science training.

10:30 AM

S1-4 "A Course in Physics Education Research for Teachers"

Michael Wittmann
Department of Physics & Astronomy, The University of Maine
wittmann@umit.maine.edu

How does one open a pipeline that brings new teachers into the profession? One path is to promote educational aspects of research in physics through the promotion of physics education research. In the past year, I have been working with collaborators to develop a course in physics education research that combines the following elements: 1) a strong grounding in physics content knowledge, 2) a focus on research into student learning of the physics, 3) the use of research-based curriculum tools that promote student learning

In this talk, I will describe the course design and skills we expect students leaving the course to have. A research agenda for the coming year will also be described, with a special emphasis on the interplay between pedagogical and content knowledge.

Session 2 (S2): Research into Student Learning I
Monday, June 24, 2002 – 9:00 AM to 10:45 AM
120 Little Hall
Presider: Larry Latour

9:00 AM

S2-1 Invited Talk "A Model of the Science Learner"

William R. Robinson
Department of Chemistry, Purdue University
wrrobin@purdue.edu

According to a model derived from cognitive science, the knowledge frameworks that act as our explanatory and predictive devices are composed of three components. (1) What can we know about entities? How can we know it? (epistemological commitments) (2) How can we classify entities? How do we expect them to behave? (ontological commitments) (3) What do we know about entities? How can we predict and explain their behavior? (domain-specific explanatory principles). The importance of this model lies in its implication that learners need to change their beliefs about the behavior of matter in addition to changing their content knowledge. Thus,

meaningful science learning usually involves changes not only in the domain-specific principles but also in the epistemological and ontological commitments of a learner's frameworks. The model will be described and examples from chemical education research that show how the various components of a knowledge framework interact with teaching and learning will be presented.

9:30 AM

S2-2 **"**Identifying and Addressing Student Difficulties with Two-dimensional Kinematics"

John R. Thompson
Department of Physics, Grand Valley State University (The University of Maine after August, 2002)
thompsjo@gvsu.edu

I will discuss an investigation of student difficulties with acceleration in two dimensions. Previous research by others has identified several prevalent difficulties in this topic. Recent research has shown that students exhibit novel difficulties in this topic when asked to apply their understanding of 2-D *horizontal* motion to the context of *vertical* motion. Based on the results of this research, curriculum was developed to address these novel difficulties. The effectiveness of this curriculum in addressing both previously- and newly identified difficulties will be discussed. Research results will be drawn from responses to written pretest and post-test questions.

10:00 AM BREAK

10:15 AM

S2-3 Invited Talk "Issues at the Intersection of Science and Culture: Lessons learned from teaching the Earth sciences in Southern California Native American communities"

Eric Riggs
Department of Geological Sciences, San Diego State University
eriggs@geology.sdsu.edu

Research in science education has proceeded in recent years with the explicit recognition that there are unique barriers, needs and opportunities in teaching the increasingly ethnically and culturally diverse body of students encountered in K-12 and college classrooms. Also, most scientific disciplines have collectively come to realize that diversity in their own ranks is not what it should be, and that the general scientific literacy in ethnic and cultural minority communities is also often low. This talk will summarize the theoretical and practical issues in cross-cultural science education that have contributed to this state of affairs, and then turn to focus on the lessons learned in the first four years of the Indigenous Earth Science Project. The IESP works with Southern California Native communities to build local expertise in the Earth and environmental sciences on reservations, and also runs programs designed to bring elementary to high-school age children into science through directed learning experiences on their home reservations. We will present results of the project to date, as well as describe curricular approaches currently being developed in Southern California and elsewhere in North America that attempt to integrate culturally-based, traditional scientific knowledge with mainstream Earth science knowledge.

Session 3 (S3): Research-based Curriculum Innovation and Curriculum Assessment (Post-Secondary)
Monday, June 24, 2002 – 9:00 AM to 11:00 AM
130 Little Hall
Presider: Susan McKay

9:00 AM

S3-1 "Do Students Learn More from Some Demonstrations Than Others?"

Adam P. Fagen
Program in Molecular Biology and Education, Harvard University
afagen@fas.harvard.edu

We previously compared the effectiveness of different modes of performing classroom demonstrations and found that students who passively observe demonstrations understand the underlying concepts no better than students who do not see the demonstration at all.* Furthermore, students who simply predict the demonstration outcome before seeing it display significantly greater understanding. Here, we extend this study to examine the role of pedagogy with demonstrations developed as part of a research-based curriculum designed to address student misconceptions. We selected individual demonstrations from the Interactive Lecture Demonstrations curriculum of Sokoloff and Thornton (1997) and presented them in different modes with different degrees of engagement to different sections of students. We then assessed students' ability to correctly predict and explain the outcome of identical physical situations and compared performance with the mode of presentation for each student.

* Fagen et al., 2002 AAPT Meeting; manuscript in preparation

9:15 AM

S3-2 "What Happens When You Change Everything at Once?"

Corinne A. Manogue
Department of Physics, Oregon State University
corinne@physics.orst.edu

The Paradigms in Physics Program at Oregon State University has totally reformed the entire upper-division curriculum for physics and engineering physics majors. This has involved both a rearrangement of content to better reflect the way professional physicists think about the field and also the use of a number of reform pedagogies that place responsibility for learning more firmly in the hands of the students. Along the way we are learning about what it takes to successfully design and implement large scale modifications in curriculum, to institutionalize them, and to help faculty learn how to design effective classroom activities and employ them in the classroom. We intend to share some of our joyful experiences and hard-learned lessons with others embarking on similar journeys.

9:30 AM

S3-3 Invited Talk "Redesign of Introductory Biology at the University of Massachusetts: Assessment of improvement in student learning and problem solving skills"

Steve Goodwin (1) & Randall Phillis (2)
(1) Department of Microbiology, University of Massachusetts, Amherst
(2) Department of Biology, University of Massachusetts, Amherst
sgoodwin@microbio.umass.edu & rphillis@bio.umass.edu

We have redesigned the introductory biology course to use a variety of instructional technology resources to support active learning in the large lecture hall. Students are asked to use a "class preparation" web site to learn basic material, consider important questions about key concepts, and take a very low stakes on-line quiz. In class, students are asked to work together to solve problems in class and then engage in whole-class discussions about problem-solving strategies. These activities are supported by an in-class communication system that allows students

to enter their solutions into a computer for compilation and display. A key focus of the course redesign project was to assess the impact of these changes on student learning. We have used several approaches to this assessment effort, including quasi-experimental comparisons of student performance between sections and a scientific reasoning test that was administered at the beginning and end of the semester. We found significant gains in student's ability to use unfamiliar scientific models to predict outcomes or interpret results.

10:00 AM BREAK

10:15 AM

S3-4 Invited Talk "Teaching Introductory Physics Through Problem Solving: "I understand the material, I just can't solve the problems"

Ken Heller
Department of Physics, University of Minnesota
heller@umphys.spa.umn.edu

At the university, most physics faculty judge student knowledge in their introductory course by how well they solve problems. The structure of such courses, as reflected in the most common introductory physics textbooks, assumes that students learn physics by doing problems. Research shows that this reasonable approach does not seem to work. This talk will discuss the justification for emphasizing problem solving, the meaning of problem solving, the beliefs of physics faculty about problem solving in introductory physics classes, and a pedagogical framework for useful problem solving.

10:45 AM

S3-5 "Geometric Visualization as the Bridge between Abstract Mathematics and Scientific Applications"

Tevian Dray (1) & Corinne A. Manogue (2)
(1) Department of Mathematics and Statistics, Mount Holyoke College
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There is an enormous gap between abstract mathematics and scientific applications, which remains largely unrecognized by both sides. Many of the techniques taught in mathematics classes do not generalize well to applications; students of mathematics are often taught to manipulate symbols without thinking about what they mean physically or geometrically, fundamental skills for applications. We will report on our experiences trying to bridge this gap by jointly teaching multivariable and vector calculus as part of an NSF-supported project, emphasizing the lessons we have learned which are applicable to more elementary courses. Specifically, we will point out the different ways mathematicians and other physical scientists view such basic concepts as functions and vectors, and offer suggestions for bridging the gap. But our most important message is that the gap exists, and both sides must be aware of it!

Session 4 (S4): Research-based Curriculum Innovation and Curriculum Assessment (Middle and Secondary)
Monday, June 24, 2002 – 9:00 AM to 11:00 AM
140 Little Hall
Presider: Molly Schauffler

9:00 AM

S4-1 Invited Talk "Reforming Middle School Physical Science: Building a curriculum from the ground up"

Patricia Heller
Department of Curriculum and Instruction, University of Minnesota
helle002@maroon.tc.umn.edu

This talk will describe the efforts of the CIPS team (Constructing Ideas in Physical Science) to build an entire 8th grade physical science curriculum that meets the National Standards as described by the National Academy of Sciences and the American Association for the Advancement of Science, uses modern pedagogical techniques and the results of research on learning, uses modern technology in an appropriate manner, conforms to the reality of the classroom, conforms to the reality of teacher preparation, and recognizes the constraints of today's schools.

9:30 AM

S4-2 "CIPS - A Middle School Physical Science Curriculum: Challenges in promoting student learning and teacher implementation"

April Maskiewicz, Fred Goldberg, and Sharon Bendall
Center for Research in Math and Science Education, San Diego State University
amaskiewicz@ucsd.edu

CIPS, Constructing Ideas in Physical Science, is an inquiry-based, yearlong physical science course for middle school students (7th and 8th grade). Funded by NSF, CIPS is based on research in student learning, NSE Standards, Project 2061 Benchmarks, and was guided by Project 2061 evaluation criteria. CIPS employs a learning-cycle pedagogy where the sequencing of activities is carefully designed to provide opportunities for students to develop a deep understanding of science ideas. The data suggest that the CIPS curriculum may have a significant and substantial positive impact on students' content knowledge.

Successful implementation of CIPS will require a fundamental change in the beliefs, attitudes, and teaching practices of teachers whose own science learning experiences were very different from those reflected in the national standards (Loucks-Horseley, et al., 1998). Thus, a two-year professional development package is being designed to develop teachers' practical and integrated knowledge of students, student learning, the CIPS physical science content, and the CIPS pedagogy.

10:00 AM BREAK

10:15 AM

S4-3 "Application of Computer-Aided Mathematics Teaching in a Secondary School"

Mehmet Emin Yenitepe
Department of Education, Mathematics Teaching, Bosphorus University, Turkey
meminyenitepe@hotmail.com

This is a case study that examines the effect of using presentations developed by teachers using commercially-produced educational software CD-ROM in a computer laboratory. The study looks at the impact of using this technology on student learning and as a method of teaching mathematics compared with traditional classroom teaching strategies.

In order to identify the effects of the different methods used, 82 students were taken from a military secondary school. The students were classified homogenously into three groups. The teacher who developed and used these presentations was a subject-matter expert and acted as an instructional designer.

The topic focus was understanding how the unit circle can be used to find trigonometric ratios and to calculate Sine or Cosine values of an angle. Two different techniques were used to show the unit circle and to help them imagine it: blackboard drawings and a Power Point slide presentation.

Results from survey questions administered immediately after the study showed that students from the first group were 18.5% more successful than the second group and 15.5% more successful than the third. We will share implications of these results.

10:30 AM

S4-4 "Investigating Linear and Exponential Reasoning of Students in a Reformed College Algebra Course"

Eric Pandiscio
College of Education and Human Development, The University of Maine
eric.pandiscio@umit.maine.edu

The Mathematics Department and the College of Education and Human Development at The University of Maine cooperatively developed and piloted a new general algebra course in the 2001-2002 academic year. The reformed course focused on developing the conceptual underpinning of algebraic concepts (specifically linear and exponential functions) and the ability to translate between algebraic representations (i.e., data, graphs, and equations). This talk will present the results of comparative student performances on tests of algebraic knowledge in the traditionally-taught algebra section and the reformed algebra section.

10:45 AM

S4-5 "Seeing with Light: Spectroscopy in the High School Chemistry Class"

Michele Benoit
Chemistry Teacher, Bangor High School
mybenoit@msn.com

The University of Maine Chemistry Department and Bangor High School collaborated to introduce spectroscopy to high-school general chemistry classes this past school year. This partnership allowed teachers and students to use a spectrophotometer in conjunction with The University of Maine's InterChemNet system. During this pilot program, students performed three spectroscopy labs newly adapted for high school; used the InterChemNet Lab Navigator to manage their labs, and the Spectra Analysis feature to analyze and manipulate their data. Preliminary assessment data from pre- and post lab questions, student attitude questions, and anecdotal responses will be presented.

Session 5 (S5): Teacher Preparation and Professional Development II
Tuesday, June 25, 2002 – 9:00 AM to 11:00 AM
110 Little Hall
Presider: Matthew Bennage

9:00 AM

S5-1 Invited Talk "Process and Inquiry in the Earth Sciences: Research into the design of active, inquiry-based content courses for pre-service and in-service elementary teachers"

Eric Riggs
Department of Geological Sciences, San Diego State University
eriggs@geology.sdsu.edu

As the Earth sciences gain prominence in the K-12 curriculum and in national and local science standards, many districts are now faced with a chronic shortage of teachers with the background to confidently teach geoscience, especially in the elementary grades. In response to local demand, we have initiated an overhaul of Natural Sciences 412D, a content course covering some of the "big ideas" in Earth science for pre-service teachers at San Diego State University. Along with this work comes many opportunities for development and assessment of new curricular units, and for associated research in basic teaching and learning issues in the Earth sciences. Pre-service elementary teachers at SDSU also often report mild to extreme science and math anxiety, are usually women, and represent a more culturally and ethnically diverse population than the general student body. All of these factors combined offer a unique teaching and learning research environment, and allow the development of curricula and pedagogy which are easily exported to the K-6 level with minimal adjustment. We will present the general approach to the design of this Earth science class, and also the design and results of some studies we have conducted in the development and implementation of our new curricular units in this course and in related professional development for in-service teachers.

9:30 AM

S5-2 "Effectiveness of Student Investigations in High School Science"

Mark Miksic
Queens College of CUNY
mgmiksic@qc.edu

The use of the Scientific Method in the teaching of laboratory science to science students has become ubiquitous. This paper reports on an investigation of a group of high school teachers within the structure of a graduate seminar at Queens College. They were encouraged into investigating their teaching practice and that of their colleagues as well as the experiences and responses of their students who employed some version of the 'Scientific Method' while doing science laboratories. The results cast some doubt on the effectiveness of the Scientific Method as a vehicle for teaching the practice of science and the concepts of science to high school students.

10:00 AM

S5-3 "An Initial Analysis of a Masters Program for In-service High School Science Teachers in Mexico (Morelos)"

Authors: Laura Osornio (1) and Janet Paul de Verjovsky (2)
(1) Coordinator of Department of Educational Mathematics, UAEM, Morelos, Mexico
(2) Coordinator of Biology in the Masters in Science Teaching, UAEM, Morelos, Mexico
ume@buzon.uaem.mx, loa_56@yahoo.com.mx, janet_verjovsky@yahoo.com

The Autonomous University of Morelos (UAEM) began a masters program for science teaching (MEC) in July, 1999, for teachers of the ten incorporated preparatories. Very low achievement of these students in national and local examinations indicate a particularly serious problem in science teaching. Relevant factors identified include teachers' contracts and salaries, absence of teacher training, teaching of subjects outside their specialties.

Eleven inservice teachers have completed the coursework and begun their theses. In May, 2000, their conceptualization of the nature of science (NOS) was analyzed, with a second application in May, 2001, given also to 13 non-MEC science teachers. The MEC teachers showed a notable improvement in the coherency of their positions compared to their first results and the non-MEC. Interviews also showed changes in attitudes and practices of the MEC teachers. A case study of two biology teachers is in progress, from 2000 to 2003, to identify their beliefs and practices.

10:15 AM BREAK

10:30 AM

S5-4 Invited Talk "Second Teaching: Small groups act as mentors in science learning"

Lisa Novemsky
Brooklyn College School of Education
novemsky@brooklyn.cuny.edu

Non-traditional students have not succeeded in traditional science education. Second teaching is a new pedagogical construct – a model of small group activity designed to follow initial instruction, or first teaching. Following Vygotsky's ideas, second teaching works to facilitate individual learning processes in a diversity of students who find a new academic domain foreign. In the process of second teaching, the collective wisdom of a small group acts as a mentor to individual learners. Many non-traditional students do well in a learning environment where second teaching is fostered. In various situations that use second teaching, non-traditional students have done well.

Session 6 (S6): Research into Student Learning II
Tuesday, June 25, 2002 – 9:00 AM to 11:00 AM
120 Little Hall
Presider: Susan McKay

9:00 AM

S6-1 Invited Talk "Developing Student Expectations in Algebra-based Physics"

E.F. "Joe" Redish
Department of Physics, University of Maryland
redish@physics.umd.edu

Students bring to their classes not only misconceptions about how the world works, but about how it is appropriate to learn about how the world works. These can not only limit and distort their learning, but it can limit and distort what we expect from them and try to accomplish through our instruction. In our project at the University of Maryland, "Learning to Learn Science," we are studying students' expectations about the construction of their knowledge in the class and we are developing ways to help them transform their expectations, assumptions, and attitudes into ones that are more productive for learning science.

9:30 AM

S6-2 "Programming as a Powerful Tool for Learning"

Larry Latour
Department of Computer Sciences, The University of Maine
larry.latour@umit.maine.edu

Programming is a powerful tool for constructionist learning. This talk provides an overview of the work of the PAL (Programming and Adaptive Learning) research group - utilizing a variety of programming models to enable middle school students to harness the power of the computer. We will discuss the art and craft of programming, showing how we help teachers to construct, explore, and analyze real and virtual models. We will also discuss a wide variety of tools available to us - Logo, Lego robotics software, Starlogo, Stagecast Creator, and Agentsheets.

9:45 AM

S6-3 "From Bouncing Balls To Kinetic Theory: Model-based reasoning as an emergent process"

Nicole M. Gillespie
Graduate School of Education, University of California, Berkeley
ngillesp@uclink.berkeley.edu

How scientists construct and use models constitutes a large part of the science studies literature, and a similarly large percentage of science education literature focuses on the development of model-based reasoning in students. However, the actual process by which students come to productively use models is often treated as a "black box" or "revolutionary" conceptual change in the education literature. The aim of this paper is to explore how model-based reasoning develops among a group of undergraduate physics students trying to make sense of the behavior of gases. I analyze the students' discussion from three related perspectives: interactional frames, gestures and the types of responses the students gave to my questions. The convergence of these three analyses suggest that the development of model-based reasoning can be seen as a process which is emergent in interaction rather than a revolutionary change in the way students think.

10:00 AM

S6-4 Invited Talk "Setting the Stage: Task choice for rich mathematical discussion in differential equations"

Karen King
Department of Mathematics, Michigan State University
kdking@math.msu.edu

This talk will discuss the use of two separate but complimentary theoretical constructs that influenced task choice on the first day of a differential equations course in order to develop rich mathematical discussions. The first theoretical construct, progressive mathematization, part of the Realistic Mathematics Education theoretical framework, influenced the content of the task and our hypothetical learning trajectory that placed this task in the curriculum stream to advance mathematical learning. The second theoretical construction, sociomathematical norms, influenced the organization and framing of the task and our wish to have students participate in the classroom in particular ways in order to advance their mathematical practices. I will end the talk with implications for future curriculum design

10:30 AM

S6-5 "A Methodology for Investigating Students' Understanding of Mathematical Concepts"

John E. Donovan II (The University of Maine after August, 2002)
Department of Mathematics & College of Education and Human Development, The University of Maine (Beginning Fall 2002)
jed3@buffalo.edu

Concepts in mathematics are often represented with equations and graphs yet the meaning these symbols have for individuals is not universal. What may have a deep and varied meaning for one person may hold very little, or no, meaning for another. To oversimplify this point, consider the meaning an algebraic differential equation like $dy/dt = 3y - 6$ might have for a pre-calculus student. What does it mean to you?

In this talk a methodology used to investigate the students' understanding of algebraic and graphical representations of first-order ordinary differential equations will be discussed. A three-interview sequence that included open-ended prompts, a card sorting activity, and non-routine tasks allowed participants to be observed in repeated interactions with the same type of representation. From this data, detailed descriptions of the participants' understanding of the different representation types were produced. Potential uses of this methodology as a tool to investigate students' understanding of other mathematical concepts will be discussed.

Session 7 (S7): Research-based Curriculum Innovation and Curriculum Assessment III
Tuesday, June 25, 2002 – 9:00 AM to 11:00 AM
130 Little Hall
Presider: Robert Franzosa

9:00 AM

S7-1 Invited Talk "Lecture-Free Teaching In College Science Courses"

Bonnie Wood
Department of Biology, University of Maine at Presque Isle
wood@polaris.umpi.maine.edu

My desire for reform grew out of my frustration and disappointment with the inability of my generally under-prepared students to apply scientific knowledge to questions requiring critical thinking. Two years ago during a sabbatical semester, I researched and designed a fundamental departure from my previous didactic pedagogy. As a result, I now teach all my college science courses using lecture-free active learning.

During the talk and the subsequent workshop, I will briefly describe the steps I use to remodel a science lecture course into an active learning format. With participants assuming the role of students, I will simulate a typical class meeting of an introductory level science course. I will demonstrate the interplay of student preparation before class, peer instruction, and active learning exercises to achieve course content identical to that of a lecture-based course.

I will conclude by describing the methods by which I am assessing the effectiveness of lecture-free teaching.

9:30 AM

S7-2 Invited Talk "Getting Serious About Thinking in College General Chemistry"

Chris Bauer
Department of Chemistry, University of New Hampshire
chris.bauer@unh.edu

Developments in the learning sciences, encompassing studies in cognition, motivation, instruction, assessment, technology design, and neuroscience, are providing groundwork for instructional decisions. I will discuss how we have applied these ideas in making decisions about curricular goals and structure for college general chemistry. In particular, we have begun an attempt to build a learning community in a 700-person general chemistry course by melding key features of the NSF Chemistry Systemic Initiatives with existing computer-based laboratory facilities and with the unique UNH Preparing Future Faculty programs. We hope to demonstrate student intellectual growth along three dimensions - conceptual understanding, metacognitive ability, and motivation to learn. We also hope to create an environment in which students feel "known" despite the large population and in which helping each other learn is valued. I will highlight the Peer-Led Team Learning groups and Calibrated Peer Review web-based writing assignments.

10:00 AM

S7-3 Invited Talk "New Directions in Teaching Chemistry"

James Spencer
Department of Chemistry, Franklin and Marshall College
J_SPENCER@acad.fandm.edu

Over the past 20 years research in cognitive science, educational psychology, and classroom experiments has shown that there is an alternate philosophical and pedagogical approach to learning in the sciences. The new paradigm differs considerably from the teacher-centered practices of the past 1000 years. Research has made clear that active students learn more than passive students, that greater student involvement in the learning process is needed, and that the emphasis should be placed on producing learning rather than on providing instruction. Constructivist principles and the learning cycle may be combined to produce a student focused active classroom

environment that conforms more closely to the structure described by recent research than is provided by the traditional model. A brief overview of the theoretical underpinnings and how the results of research on learning translate into a changed classroom setting will be presented. A practical application of the new understanding of the student role in a typical cooperative learning classroom will be demonstrated. The conduct of the class and materials that conform to the guided inquiry educational hypothesis will be detailed.

10:30 AM

S7-4 Invited Talk "Studio Calc/Phys: Combining calculus, physics, and active learning"

Dawn Meredith
Department of Physics, University of New Hampshire
dawn.meredith@unh.edu

To help students make connections between calculus and physics, we developed a curriculum that combines the two subjects. Wherever possible, students immediately apply the mathematics to physical applications; the physics is then applied to real-world situations. In addition to making clear the connections between calculus and physics, we used other effective pedagogical techniques: group work, project-based learning, structured problem solving, writing to learn, and focus on conceptual understanding. This talk will focus on how education research guided the design and assessment of this course.

Session 8 (S8): "Methods of Conducting Research into Student Learning"
Tuesday, June 25, 2002 – 9:30 AM to 10:45 AM
140 Little Hall
Presider: Stephen Kaback

9:00 AM

S8-1 "Impact of Peer-Led Team Learning (PLTL) in a PER-Materials-Based Introductory Course"

David Batuski, Jeffrey Morgan, & Stephen Kaback
Department of Physics & Astronomy, University of Maine
david.batuski@umit.maine.edu, jeffrey.morgan@umit.maine.edu & steve.kaback@umit.maine.edu

At the University of Maine, PHY 111/112 is the algebra-based Introductory Physics sequence, and tutorial materials resulting from Physics Education Research (PER) have been used in the twice-weekly recitation periods for these courses for the last two years. Also, beginning in Spring 2001, we have employed peer-leaders in an adaptation of the PLTL Workshop model in most of the recitation sections. We present statistical comparisons of examination results for sections that had peer-leaders and ones that had more traditional TA-only recitations. While the Spring 2001 sections had essentially no difference in exam scores, the Fall 2001 PLTL advantage was substantial but not startling. We consider possible reasons why we are not finding the large performance gains reported by other institutions after implementing PLTL.

9:15 AM BREAK

9:30 AM

S8-2 Invited Talk "A Framework for Making Sense of Interviews and Observations"

Patrick Thompson
Department of Mathematics, Vanderbilt University
Pat.Thompson@vanderbilt.edu

While it is relatively easy to gather video data and field notes, making sense of what they've captured can be a challenge. This is often due to not having a well-formed image of what constitutes a theory-guided observation or a theory-oriented hypothesis. This talk will address ways to collect and analyze qualitative data so as to generate reliable, useful knowledge about mathematics learning and teaching.

10:00 AM

S8-3 "Using Individual Student Interviews to Understand Student Models of Current Flow"

Rachel E. Scherr, Physics Education Research Group, Department of Physics, University of Maryland
Michael C. Wittmann, University of Maine
rescherr@physics.umd.edu & michael.wittmann@umit.maine.edu

In clinical (individual demonstration) interviews, students are challenged to describe their model of the physics of a given situation in a one-on-one discussion with a researcher. In an open-ended interview, the structure of the discussion is determined by both the student's knowledge and the goals of the interviewer. This talk will describe one interview in which a student showed several distinct states of physics knowledge, epistemological stance, and model-building ability. Diagnosing such student states is central to both research contexts and classroom interactions.

10:15 AM BREAK

10:30 AM

S8-4 Invited Talk "Science Literacy: What it is and why there isn't more of it"

Gordon Uno
Department of Botany and Microbiology, Oklahoma University
guno@ou.edu

By several measures, the general public possesses a great interest in issues related to science and technology but lacks scientific literacy. Literacy, however, is not simply an ability to comprehend news reports and articles that deal with science; a proposed model identifies four different kinds, or levels, of scientific literacy. We will explore these different levels and discuss what role the instructors of science courses play in the literacy of future citizens and science majors. In addition, we will determine what are the key elements of contemporary courses that promote the different levels of science literacy.

Workshop Abstracts

Workshops (W1) – (W5)
Monday, June 24, 2002
1:30 PM to 3:30 PM

W1 "Developing and Assessing Inquiry-Based Materials for Teacher Education"
110 Little Hall

Jacqueline E. Huntoon
Department of Geological Engineering and Sciences, Michigan Technological University
jeh@mtu.edu & gbluth@mtu.edu

In this workshop participants will first work through an inquiry-based module designed for teacher training. Participants will then design a basic assessment tool for the module. The module focuses on earth science and math content areas. It asks participants to collect data from a dinosaur trackway, and then use the data and a set of empirical equations to estimate the size and speed of the dinosaurs that made the tracks. Participants are then asked to test the method by using the empirical equations to estimate their own size and speed based only on their footprints. The estimates made using the empirical equations are then compared to actual, measured values of size and speed. The module allows participants to employ the scientific method by collecting and interpreting data, and developing and testing hypotheses.

After completing the module, participants will learn to develop pre- and post-module assessments to identify attitudinal shifts, and changes in lower and higher-order thinking skills. This type of module can serve as a model for development of inquiry-based teacher education materials because its content emphasizes performing scientific investigations, and its content can be readily modified for use in K-12 classrooms.

W2 "Non-Traditional Ways of Assessing Chemistry Learning"
120 Little Hall

William R. Robinson
Department of Chemistry, Purdue University
wrrobin@purdue.edu

Assessment falls into two categories: formative assessment that is used to find out how our students are understanding our courses, and summative assessment that we generally use for assigning grades. This workshop will consider several techniques, other than standard questions and problem sets, that can be used for such assessment.

W3 " Cooperative Group Problem Solving"
130 Little Hall

Ken Heller & Patricia Heller
Department of Physics, University of Minnesota
heller@umphys.spa.umn.edu & helle002@maroon.tc.umn.edu

This workshop will focus on developing effective curriculum to teach physics through problem-solving. The workshop will include designing problems, designing a student problem-solving framework, and designing the learning environment.

W4 "With Microscopes and Moccasins: American Indian success in math and science"
140 Little Hall

Maureen Smith
Department of Interdisciplinary Studies, The University of Maine
maureen.smith@umit.maine.edu

In this workshop, participants will discover strategies that work with American Indian students in the fields of math and science. Included in this workshop will be a comprehensive model for the inclusion of math and science within a culture circle, an overview of American Indian learning styles, cultural obstacles to engagement, suggestions for assessment and motivational tools for American Indian students. I will also briefly present some of the success we have found at the University of Maine with our grant from MU-SPIN, a branch of NASA in working with American Indian students in math and science, with the hope of expanding our outreach. As an interactive workshop, we will begin to develop approaches for use in participants' classrooms.

As an American Indian, I found that math and science seemed to be separate from my cultural background. Through my research, I found out how wrong my perception was. It is my hope that the current practice will prove my experience to be a relic of the past, that American Indian students of the future will not need to decide between moccasins or microscopes.

W5 "Programming as a Powerful Tool for Learning"
224 East Annex Hall [NOTE: Enrollment limited to 20 participants]

Larry Latour
Department of Computer Science, The University of Maine
larry.latour@umit.maine.edu

Programming is a powerful tool for constructionist learning. This workshop provides an introduction to Logo, Lego Robotics, and multi-agent programming for middle school. We will explore the art and craft of programming, helping teachers to construct, explore, and analyze real and virtual models. We will look at various forms of programming, visual and textual, simple and complex, building virtual worlds on the computer and real robots performing real tasks.

Workshops (W6) – (W9)
Tuesday, June 25, 2002
1:30 PM to 3:30 PM

W6 "Lecture-Free Teaching In College Science Courses"
110 Little Hall

Bonnie Wood
Department of Biology, University of Maine at Presque Isle
wood@polaris.umpi.maine.edu

My desire for reform grew out of my frustration and disappointment with the inability of my generally under-prepared students to apply scientific knowledge to questions requiring critical thinking. Two years ago during a sabbatical semester, I researched and designed a fundamental departure from my previous didactic pedagogy. As a result, I now teach all my college science courses using lecture-free active learning.

During the workshop I will briefly describe the steps I use to remodel a science lecture course into an active learning format. With participants assuming the role of students, I will simulate a typical class meeting of an introductory level science course. I will demonstrate the interplay of student preparation before class, peer instruction, and active learning exercises to achieve course content identical to that of a lecture-based course.

I will conclude by describing the methods by which I am assessing the effectiveness of lecture-free teaching.

W7 " Analyzing Qualitative Data"
120 Little Hall
Patrick Thompson
Department of Mathematics, Vanderbilt University
pat.thompson@vanderbilt.edu

This workshop will elaborate the examples given in my talk. Participants will engage in small-group activities aimed at highlighting conceptual and methodological issues at play when attempting to make sense of interview and observational data.

W8 "Workshop on Guided-inquiry Instruction in Chemistry"
130 Little Hall
James Spencer
Department of Chemistry, Franklin and Marshall College
J_SPENCER@acad.fandm.edu

This workshop will allow participants to experience a cooperative learning classroom structured according to constructivist and learning cycle principles. The philosophical and pedagogical basis on which this approach is based will be described. The set-up and conduct of a lecture-less, student focused environment in which students work in small groups under the mentorship of an instructor will be demonstrated. Guided inquiry worksheets designed to guide students to develop concepts for themselves provide the basis for group work. A classroom set up in this way provides for social interaction by giving the learner the opportunity to test new knowledge through interaction with peers. The instructor is then in a position to listen to and learn from the students. The focus of the workshop will be the demonstration of the group learning experience in general chemistry. Examples of discovery or guided inquiry general chemistry laboratory experiences will be presented. The same principles have been applied to group learning in physical chemistry and organic chemistry and courses in both areas have been developed using the same cooperative structure.

W9 " Studio Calc/Phys: The challenges in creating an interdisciplinary course"
140 Little Hall
Dawn Meredith
Department of Physics, University of New Hampshire
dawn.meredith@unh.edu

This workshop will give details on how we managed (both pedagogically and administratively) to combine two courses. Participants will have the opportunity to work on combined calculus/physics activities and to consider the challenges at their own institution to creating a similar course.

Poster Abstracts

Poster Session (P1)
Sunday, June 23, 2002
7:30 PM to 9:00 PM

P1-1 "Bringing Education and Science Research into the Classroom: Two New Courses for Teachers"

Molly Schauffler & Jeffrey Owen
Department of Earth Systems Science, The University of Maine
mschauff@maine.edu & jeffrey.own@umit.maine.edu

Two new courses offer 6-12 teachers integrated instruction in pedagogy, educational research, and environmental science research experience. One course, Earth Systems Science (piloted for Fall 2002), focuses on teaching Earth System concepts in middle- and high-school science classes using research-based pedagogy. The other course, Monitoring Environmental Change (taught in Fall 2000 and 2001), gives teachers direct experience in scientific research and environmental science concepts through designing and conducting an open-ended, locally-relevant environmental research question. (For example, "A full-year watershed approach to K-16 monitoring of vernal pools".)

Evaluations from teachers who have taken Monitoring Environmental Change placed high value on gaining science skills and confidence-building experience, and the applicability of bringing research into the classroom.

Both courses are sponsored in collaboration by University of Maine Dept. of Continuing Education, Dept. of Geological Sciences, Center for Science and Mathematics Education Research, and with support from National Science Foundation.

P1-2 "Collaborative Professional Development for Standards-based Science Instruction: A conceptual framework"

Sebert, S. D., Cezikturk, O., Van Benschoten, M. and Sherwood, S. A.,
State University of New York, Albany
crsep@lycos.com

The project, *Assessment in the Service of Standards-Based Teaching*, seeks to expand and define the content and pedagogical knowledge of K-8 teachers in order to promote universal student attainment of New York State and National Science Standards. Our philosophy brings teachers into the design and implementation of on-going professional development. Begun in 2000, this 5-year, NSF-funded project partners the University at Albany, SUNY, with four local school districts. The project plan focuses on building a self-sustained professional development culture that supports all the stakeholders throughout the life of the grant and beyond. This project uses relational concept maps and diagrams to enhance teacher content knowledge by illustrating the connections between scientific concepts and principles. In the classroom, teachers can use similar maps for formative assessment to enhance student content knowledge. It is projected that this professional development will increase student learning as evidenced by greater achievement on state-mandated tests.

P1-3 "Research in Changes in Conceptual Understanding as Reflected in Changes in Discourse Practices in Continuing Medical Education"

(1) Mary Banach, (2) Bernard Gifford, (2) Mark Holodniy
(1) University of California at Berkeley
(2) Stanford University Medical Center
mbanach@uclink4.berkeley.edu

This study focuses on measuring changes in conceptual understanding as reflected in changes in discourse practices during a one-day workshop on HIV treatment practice. The field of HIV medicine has changed dramatically in the last seven years with the advent of highly active antiretroviral therapy (HAART). One of the ways that clinicians remain up-to-date on decision-making strategies in HIV treatment practice is by attending one-

day workshops. These clinicians have a diverse set of backgrounds, representing many types of specialties (infectious disease physicians, family practitioners, nurse practitioners, physician's assistants), practices (individual to large group), and geographic locations (rural to urban inner city). After presentations on molecular biology, studies on the use of resistance testing, and the latest findings in drug-related HIV genetic mutations, case studies are discussed. These discussions are used as a tool to evaluate the integration of the material that was presented earlier in the workshop.

P1-4 "Preparing Pre-service and In-service Elementary Teachers to Teach Sound"

John R. Thompson
Department of Physics, Grand Valley State University (The University of Maine after August, 2002)
thompsjo@gvsu.edu

Sound is a topic that is covered at many levels. I am investigating the extent to which in-service and pre-service elementary teachers understand sound. This research is taking place in the context of the development of an inquiry-based curriculum to prepare these teachers to teach sound. Many teachers had difficulties connecting the properties of the perceived qualities of a sound (pitch, volume) to the properties of the physical quantities (frequency, amplitude). This poster will display research results drawn from responses to written pre- and post-test questions during the curriculum development process, as well as informal classroom observations.

P1-5 "Field-based Investigations of the Earth System"

Douglas N. Reusch
Department of Geological Sciences, The University of Maine
reusch@maine.edu

Local field sites afford excellent opportunities for developing understanding of the earth system at every level. The primary objective of this project was to develop field-based earth science resources in accordance with the National Science Education Standards (NSES). The prototype was a two-month unit of instruction in which ninth grade students mapped the area adjacent to their school, collected and analyzed samples, and deciphered the local geological history. These experiences provided a foundation for developing understanding of plate tectonics, climate and sea-level change, and biologic evolution. The field-based approach was then extended to pre-high school levels (K-8) at North Haven Community School. Using the NSES as a guide, elementary-level students collected samples from nearby field sites and analyzed various properties of these materials. Middle-level students concentrated on mapping these materials in the field, making cross sections, and interpreting the local history. Correlation charts (multi-thread time lines) were used to explore connections between local and larger-scale tectonic, sea level, climate, and biologic events. High school students built and ran a basic computer model pertinent to understanding geochemical cycles, energy flows through the earth system, and population dynamics.

P1-6 "Battling Student Resistance to Linear Reasoning: Attempting to teach linear reasoning through modeling laboratories in introductory physics"

Donald Mountcastle, Jeffrey Morgan, & Stephen Kaback
Department of Physics & Astronomy. The University of Maine
donald.mountcastle@umit.maine.edu, jeffrey.morgan@umit.maine.edu, & steve.kaback@umit.maine.edu

Physics and mathematics instructors make frequent use of linear models to describe relationships between variables. After ten years of collecting data on linear reasoning, we have found clear indications that students have much more trouble with linear reasoning than many physics and mathematics instructors would like to believe. This poster will share survey data on one diagnostic question used in this research and describe the results from two different laboratory interventions designed to address linear reasoning deficiencies. As it turns out, our familiar chorus of $y = mx + b$ sometimes proves to be more of a deterrent to understanding linearity then a help.

P1-7 "Brain Science and Learning Math"

Linda Rottmann
Department of Mathematics, The University of Maine
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New technologies have enabled brain researchers to better understand biological processes that occur in the brain as people acquire new learning. Could it be that helping students understand these processes – how their brain works – would improve their ability to learn and remember new material in their college courses? Linda Rottmann has been teaching "brain Science" to her developmental math students for the past three semesters. In this poster session, Linda will share her experiences and her approaches to creating a brain friendly learning environment for her students.

P1-8 "Catalyst for Discipline-Based Research and its Applications in the Teaching and Learning of Science and Mathematics"

Susan McKay
Department of Physics & Astronomy, The University of Maine
susan.mckay@umit.maine.edu

The University of Maine's new Center for Science and Mathematics Education Research brings together University faculty, students, and K-12 teachers from the sciences and mathematics to focus on discipline-based education research and its application to curriculum reform and teacher training initiatives. One current project includes the development of new courses integrating content, related research and research-guided pedagogy for a Master of Science in Teaching (MST) Program. Other projects target reform of introductory courses in science and mathematics to attract more students into these disciplines and to make these courses suitable as training laboratories for future teachers. In connection with these course reforms, active learning strategies such as Peer Led Team Learning have been introduced and their impacts on student achievement and retention are being evaluated in introductory chemistry and physics courses. New mathematics courses for future teachers are being developed, offered, and assessed. In the Department of Chemistry, on-line assessment tools have been added to the InterChemNet system to evaluate and improve student learning. Working with current and future teachers, the Department of Computer Science is designing curriculum modules for middle school students that will help them use computers to explore mathematics and science concepts. By spanning many departments and three colleges (Liberal Arts and Sciences, Natural Sciences, Forestry, and Agriculture, and Education and Human Development) on the University of Maine campus, Center activities bring to the campus community and beyond a heightened awareness of the importance of research-based pedagogy. The Center serves as resource for the establishment of academic programs within science and mathematics departments that include education research in their discipline, such as graduate offerings in chemical education within the Chemistry Department. It also provides opportunities for K-12 teachers to become involved with research projects and curriculum development.

Additional posters will be given by several presenters from the Monday and Tuesday morning sessions. We hope this will provide you an opportunity to interact with their ideas and research if you cannot attend their talk due to scheduling conflicts with other talks.

Poster Session (P2)
Monday, June 24, 2002
5:00 PM to 6:30 PM

P2-1 "Integrating Astronomy Research Methodologies, New Results, and Critical Thinking into Introductory Lectures and Laboratories for Non-Science Majors and Pre-Service Teachers"

Esther L Zirbel
City University of New York & Yale University
zirbel@astro.yale.edu

Astronomy Laboratories for Non-Science Majors will be presented that are an outgrowth of current research topics. The Labs are somewhat different from traditional labs in several ways. One goal is to give students a hands-on experience of how modern (and ancient) researchers make (made) discoveries – how they think, how they experiment, and how they reach their conclusions. Rather than letting students merely follow mindless cookbook instructions, a large emphasis is on asking the students to make the connection between the methodology, the objective, the analysis and the interpretation of the experiment. The labs thus contain several leading questions to induce critical thinking and make the students realize why they are doing what. The initiative is not only to show them how to make discoveries, but also to make them realize that this is something they could do too – provided they learn appropriate scientific methodologies and critical inquiry. Some student responses to these labs are also listed. Initially most students are rather resistant, but towards the end of the semester about half of the students comment that they learned something and about a quarter of the students feel inspired.

P2-2 "Computer Engineering Course for K-12 Teachers"

Patton, J., Eason, R., Sheaff, A.
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A sophomore-level course is being designed that introduces computer engineering fundamentals to pre-service and in-service science and math teachers in a highly interactive, hands-on environment, using active, cooperative learning methods. It illustrates how to use microprocessor based, mini-data acquisition systems, and robotics to create projects demonstrating physics and math concepts satisfying the Maine Learning Results and other national education standards

This project introduces the engineering application of science and math, and it provides a bridge between such informal science innovations as First Robotics, First Lego League, Bot Ball, etc. and the classroom environment. The major benefit to the engineering establishment is the application of and emphasis on ***engineering*** concepts to the science/math K-12 infrastructure. Through this course, pre-service and in-service teachers will be equipped with the tools to illustrate engineering principles and how they relate to concepts normally taught in conventional science and math courses.

P2-3 "Methods of Teaching Algebra"

Lindsay Junkins & Terri Shaw
The University of Maine
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The University of Maine offers several different algebra classes taught in a variety of ways. MAT103 offers algebra lessons in a project-based, team-learning atmosphere; MAT 111 is a traditional lecture/test course, and ONM 012 is a refresher course in introductory algebra. For this research, students from samples of these classes were surveyed to determine what they felt made them more successful in their classes. Overall, students were found to prefer a classroom that encouraged their involvement in the lesson, offered real-life examples for the material, and had a teacher who was enthusiastic about the material being presented.

P2-4 "Student Motivation"

Robin Kennedy
Corinna Jr. High School
rkennedy@msad48.org

An important part of the science curriculum is a long-term science project. I wanted to change my practices to increase student desire and participation. Through previous research I discovered that student motivation will increase with a connection to the student's responsibility and involvement in the development and assessment of the project. The use of student-developed learning contracts (individualized assessment), timelines, e-mail mentors, and student-to-student discussion groups was explored throughout the semester. An end of year survey was used to examine student reaction as well as comparing grades and numbers of participants to determine changes in student motivation.

P2-5 "Student Professional Development Materials For Constructing Physics Understanding Among Prospective And Practicing Elementary School Teachers"

Fred Goldberg & April Maskiewicz
Center for Research in Math and Science Education, San Diego, CA
fgoldber@sciences.sdsu.edu & amaskiewicz@ucsd.edu

As part of a new NSF funded project we are developing a one-semester physics course for prospective and practicing elementary teachers. The inquiry-oriented course, using a constructivist-oriented pedagogy similar to that developed for the CPU Project (http://cpuproject.sdsu.edu), will focus on helping prospective/practicing elementary teachers develop a deep understanding of physics content and the nature of science at the level of the middle school Benchmarks and Standards. Pedagogically designed computer simulations will complement in-class hands-on laboratories and will be used as part of interactive web-based assignments. In addition to the 60-hour content curriculum, a complementary 15-hour curriculum is being designed to help the teachers learn how K-5 students learn similar physics ideas, but at a lower level. Finally, a professional development package is being designed to help University Professors and Professional Development Providers learn more about how prospective/practicing teachers learn physics.

P2-6 "Creating a General Education Algebra Research Laboratory"

Robert Franzosa
Department of Mathematics & Statistics The University of Maine
robert.franzosa@umit.maine.edu

MAT103 "Elementary Algebraic Models in Our World" is a new mathematics course at The University of Maine designed for the General Education in Mathematics audience and to serve as a laboratory in algebra education research. The course is taught using a cooperative learning format and covers developing and studying models of linear, exponential, and quadratic equations. Details of the developed materials and preliminary assessments of the course will be presented.

P2-7 "InterChemNet: A web-based tool to develop, deliver and assess curriculum in the laboratory"

Robert Kirk, François Amar, and Mitchell Bruce, & Barbara Stewart
Department of Chemistry, The University of Maine
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barbara.stewart@umit.maine.edu

The InterChemNet system is a web-based curriculum development tool that enhances student learning in the general chemistry laboratory course. With this system, instructors select the type and sequence of experiments, including the option for students to choose between multiple experiments each week. Instructors select from a list of experiments include both mastery and discovery-based activities as well as activities that use UV-visible and FTIR spectroscopy. Each experiment contains online access to video, text, and graphical background information, links to lecture information, individualized procedures, and an online evaluation module. The on-line evaluation modules

simultaneously collect data on student learning, give students feedback, and summarize student attitudes towards particular experiments. Instructors can then use this evaluation data as a catalyst to improve the laboratory curriculum. In addition, the web-based system tracks and monitors student progress throughout the course, a key feature in promoting discovery-based curriculum within large, introductory courses. The system is capable of handling multiple courses and course sections. It has also been designed to provide an easy-to-use interface for students to work with spectroscopic data sets (UV-vis and FT-IR).

P2-8 "Enhancing Student Learning in the Laboratory with an Online Assessment Tool"

Robert Kirk, François Amar, and Mitchell Bruce, & Barbara Stewart
Department of Chemistry, The University of Maine
robert.kirk@umit.maine.edu, francois.amar@umit.maine.edu, mitchell.bruce@umit.maine.edu, & barbara.stewart@umit.maine.edu

Inter-Chem-Net is a web-based program designed to foster active learning in the lab. The system allows students choices of discovery-based experiments, a host of background information, and quick and easy access to UV-visible and FTIR spectrometers. An evaluation module is integrated into this system to provide instant feedback for students and evaluation data for instructors. The module allows instructors to monitor student learning frequently throughout the semester and is more versatile than traditional pre/post evaluations administered at the beginning and end of a course. Students are randomly assigned questions before each experiment in the lab course and different questions after each experiment. The "pre" students are then compared to the different group of students answering the same question after the experiment. All students also answer a selection of attitude questions after each experiment. These results are then immediately available for evaluation. Students in different courses and/or multiple sections of the same course can be compared quickly and easily. The module can then be used to evaluate the effectiveness of individual experiments within the course and serve as a powerful curriculum development tool, particularly for large courses. Preliminary evaluation results using this tool will be presented.

Additional posters will be given by several presenters from the Monday and Tuesday morning sessions. We hope this will provide you an opportunity to interact with their ideas and research if you cannot attend their talk due to scheduling conflicts with other talks.

Continuing Education Unit (CEU) Information
Conference Services Division
The University of Maine

The Continuing Education Unit (CEU) has been designed as a uniform unit of measurement to facilitate the accumulation and exchange of standardized information about individual participation in non-academic credit continuing education programs. The CEU permits the individual to participate in many different kinds of programs while accumulating a uniform record available for future reference.

One Continuing Education Unit is defined as ten contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction.

Examples: 5 hour workshop would award 0.5 CEU
10 hour workshop would award 1.0 CEU
22 hour workshop would award 2.2 CEU
45 hour workshop would award 4.5 CEU

What Is An EDIS CEU?
The EDUCATION IN-SERVICE CONTINUING EDUCATION UNIT (EDIS CEU) has been approved by the State Department of Educational and Cultural Services (DECS) to be used toward teacher recertification. Programs conducted under the purview of Conferences Services Division, identified by an EDIS designator, have met the criteria established by the State Department of Educational and Cultural Services for determining approval of recertification programs. The majority of EDIS courses have been offered at the request of classroom teachers or their representatives.

HERE IS SOME IMPORTANT INFORMATION TO NOTE: Since Continuing Education Units are based on ten hours of participation for each unit and the DECS recertification credits are based on 15 hours of participation for each credit, the DECS will accept EDIS CEU on a 2/3 ration.

Examples: 1.5 CEU is equal to 1 recertification credit
3.0 CEU is equal to 2 recertification credit
4.5 CEU is equal to 3 recertification credit
9.0 CEU is equal to 6 recertification credit

How to Register for CEU:
Conference Services provides a non-academic credit program completion form to participants desiring CEU records. Once you have completed a program that has received approval to grant CEU's, you can fill out a form to request a CEU transcript. The sponsor or chairperson of the program will have copies of that form available for participants when the program ends. To receive a transcript, the Conference Services office must receive a request form signed by you and the chairperson or sponsor along with payment of $5.00 for the transcript processing fee.

How are Continuing Education Units (CEU) Recorded on Your Record?
When completing the program, a participant's record of completion is recorded on that person's non-academic transcript in the Conference Services office. At the same time, a notice of completion will be forwarded to the participant.

Can CEU be Changed to Academic Credit?
CEU credit is **not** transferable to academic credit. Should you need additional information or further clarification, please contact University of Maine, Conference Services Division, Orono, ME 04469. Telephone: 207-581-4091 or Fax: 207-581-4097.

Conference Computer Clusters

The Conference Computer Cluster is located in 215 Little Hall. There you will find 20 PC-based computers with full internet access and a large variety of office and academic software programs on their hard drives. Cluster hours are as follows:

Sunday:	5 PM – 10 PM
Monday:	12 PM – 10 PM
Tuesday:	5 PM – 10 PM
Wednesday:	12 PM – 10 PM
Thursday:	8 AM – 10 PM
Friday:	8 AM – 6 PM

If you brought a personal computer with an Ethernet card to the conference, we can get you an on-campus IP address to allow you access to the internet through the campus gateway. Please contact Steve Kaback and have your computer's hardware address information available.

For other questions regarding computing and internet access, please contact Steve Kaback or leave him a message on the Conference message board in Wells Commons Lobby.

Here are some additional web addresses that may be helpful during your visit to our campus.

Campus Map and Directions	http://www.umaine.edu/locator/default.htm
Conference Services	http://www.ume.maine.edu/ced-conf/info.html
Dining Services	http://www.umerl.maine.edu/dining/
The University of Maine Home Page	http://www.umaine.edu/
Maine Center for the Arts and Hudson Museum	http://www.ume.maine.edu/~mca/
MaineBound - outdoor recreation and equipment rental	http://www.ume.maine.edu/mainebound/
Page Farm & Home Museum	http://www.ume.maine.edu/pfhm/
Computer Clusters	http://www.umaine.edu/it/itweb/compclusters.html/

Campus and Area Information

Dining Guide

The University of Maine				
Name	**Location**	**Phone**	**Type of Food**	*Price Range*
Marketplace and Union Central	Memorial Union Building	581-1799	Asian, Mexican, Pasta, Grill, Home cooking, Salad Bar, Deli	$.75 - $7.00
M. C. Fernald's (Closed Summer)	Fernald Hall	581-1404	Candy, Ice Cream and Drinks	$.75 - $5.00
Hilltop Commons	Campus	581-4842	Varied Menu	$5.00 - $8.05
Oakes Room Café (Closed Summer)	Fogler Library	581-4772	Bagels, Pastries, Coffee	$1.00 - $5.00
Stewart Commons	Campus	581-4942	Varied Menu	$5.30 - $8.50
Stodder Commons	Campus	581-4616	Vegetarian, Varied Menu	$5.30 - $8.50
University Club (Closed Summer)	Fogler Library	581-4852	Soups, Salads, and Hot Items	$5.25
York Commons	Campus	581-4959	Varied Menu, Vegetarian	$5.30 - $8.50
Orono				
Bear Brew Pub	36 Main Street	866-2739	Microbrewery Pub/Full Menu	$3.95 - $13.95
Margarita's	15 Mill Street	866-4863	Mexican	$3.89 - $12.99
Pat's Pizza	11 Mill Street	866-2111	Pizza	$1.00 - $13.50
The Store – Ampersand	22 Mill Street	866-4110	Gourmet Foods/Coffee	$5.00 - $10.00
Thai Orchid	28 Mill Street	866-4200	Thai	$4.25 - $12.95
Old Town				
China Garden	6 Stillwater Avenue	827-8228	Chinese	$7.25 - $7.95
Chocolate Grille	301 No. Main Street	827-8971	American, Late Night Menu	$3.95 - $16.95
Governor's	Stillwater Avenue	827-4277	Wide Variety Family Menu	$3.95 and up
Bangor				
Applebee's	718 Hogan Road	990-5945	American, Family Dining	$2.99 - $12.99
Asian Palace	877 Stillwater Ave	990-3838	Asian	$5.95 - $7.95
Bagel Central	33 Central Street	947-1654	Pastries, Sandwiches	$1.00 - $6.00
Bahaar Restaurant	23 Hammond Street	945-5979	Pakistani	$6.95 - $13.95
Barnaby's Restaurant	357 Odlin Road	947-6961	American	$4.25 - $17.95
Bugaboo Creek	24 Bangor Mall Blvd.	945-5515	Steak House	$7.00 - $15.00
Captain Nick's	1165 Union Street	942-6444	Seafood/Steaks	$3.95 - $16.95
China Wall	930 Stillwater Avenue	941-9331	Chinese	$4.95 - $13.50
City Slickers	193 Broad Street	941-0010	Mexican	$4.95 - $10.50
Ground Round	248 Odlin Road	942-5621	American, Family Dining	$3.99 and up
Guinness & Porcelli's	735 Main St.	947-2300	Fine Dining	$10.00 - $20.00
Jimmy V's Bar and Grill	41 Washington Street	945-5007	Pub/Full Menu	$3.99 – $11.99
J. B. Parker's	167 Center Street	947-0167	Fine Dining	$10.00 - $20.00
Killarney's	500 Main Street	947-8651	American	$4.95 - $19.95
Little Lad's Basket	128 Main Street	942-5482	Vegetarian, no eggs, no dairy	$1.00 - $4.50
Miller's/The Lion	427 Main Street	942-6361	Steak, Seafood	$3.95 - $16.95

Bangor (cont.)				
Momma B's Kitchen	96 Hammond Street	262-6143	Italian/Mediterranean	$5.00 and up
New Moon Café	47 Park Street	990-2233	Varied Menu	$4.00 - $21.95
Olive Garden	741 West Hogan Road	942-6209	Italian	$4.95 – $16.95
Oriental Jade	Bangor Mall Blvd.	947-6969	Chinese	$3.95 and up
Panda Garden	123 Franklin Street	942-2704	Chinese	$4.25 - $24.95
Paul's	605 Hogan Road	942-6726	Steak, Seafood, Ethnic	$3.95 and up
Pepino's	570 Stillwater Avenue	947-1233	Mexican	$2.95 - $12.95
Pilot's Grill	1528 Outer Hammond St.	942-6325	Maine Seafood, Fine Dining	$2.95 - $19.95
Pizzeria Uno	725 Stillwater Ave	947-5000	Pizza, Pub	$2.99 - $10.99
Ruby Tuesday's	663 Stillwater Ave	942-3442	American, Family Dining	$3.00 - $10.00
Sea Dog Brewing Company	26 Front Street	947-8004	Microbrewery, Full menu	$6.95 - $19.95
Taste of India	68 Main Street	945-6865	East Indian	$8.95 - $9.95
Thai Express	40 Broadway	947-0301	Thai	$3.00 - $7.50
Thistle's	175 Exchange Street	945-5480	Continental	$7.95 - $18.95
Whig & Courier Pub	18 Broad Street	947-4095	Pub, Full menu	$2.50 - $5.50
The Lucerne Inn	Route 1A, Dedham	843-5123	Fine Dining	$7.95 - $19.95

Transportation

Taxicab Service – Bangor	
AAA Yellow Cab 490 Broadway Bangor, ME Telephone: 945-6441	**Paul's Taxi** 1594 Hammond St. Bangor, ME Telephone: 942-9424
Airport/Rivercity Taxi 18 Bomarc Rd. Bangor, ME Telephone: 947-8294	**Penobscot Taxi Co.** 270 Hammond St. Bangor, ME Telephone: 947-4894
Chuck's Taxi Bangor, ME Telephone: 356-8888	**Pine Tree Taxi** 563 Odlin Rd. Bangor, ME Telephone: 942-2160
Dick's Taxi 547C Hammond St. Bangor, ME Telephone: 942-6403	**Town Taxi** 490 Broadway Bangor, ME Telephone: 945-5671
Taxicab Service – Old Town	
Black Bear Taxi and Limousine Service 560 Stillwater Ave. Old Town, ME Telephone: 827-2288	**Old Town Taxi** 152 Perkins Ave. Old Town, ME Telephone: 827-8800
Bus Service	
THE BUS 481 Main Ave. Bangor, ME Telephone: 947-0536 M-S 6:15 a.m. - 6:15 p.m. Jan and Doug Gibson, Owners	

Lodging

Hotels/Motels	
Bangor Motor Inn & Conference Center 701 Hogan Rd Bangor, ME 04401-3625 phone: 207 947-0355 fax: 207 947-0350 Cathy Coston, General Manager	**Econo Lodge** 327 Odlin Road Bangor, ME 04401 phone: 207 945-0111 fax: 207 942-8856 Christina Thibodeau, Sales Manager
Best Inn 570 Main St. Bangor, ME 04401 phone: 207 947-0566 fax: 207 947-0566 John Marko, Manager	**Fairfield Inn by Marriott** 300 Odlin Rd Bangor, ME 04401-6704 phone: 207 990-0001 fax: 207 990-0917 Jane Spaulding
The Best Western Black Bear Inn and Conference Center 4 Godfrey Drive Orono, ME 04473-1102 phone: 207 866-7120 fax: 207 866-7433 Tom Palmer, General Manager	**Holiday Inn - Civic Center** 500 Main Street Bangor, ME 04401 phone: 207 947-8651 fax: 207 942-2848 Paul Hilchey-Chandler
Best Western White House Inn, The 155 Littlefield Ave Bangor, ME 04401-7206 phone: 207 862-3737 fax: 207 862-3737 Leeann Hawes, Rooms Manager	**Holiday Inn - Odlin Road** 404 Odlin Rd Bangor, ME 04401-6706 phone: 207 947-0101 fax: 207 947-7619 Bret Stacey General Manager
Comfort Inn 750 Hogan Road Bangor, ME 04401-3604 phone: 207 942-7899 fax: 207 942-6463 Dennis Redman, Manager	**Hotel Equities** 63A Broad Street Auburn, ME 04210 phone: 207 942-8272 fax: 207 942-1382 Celeste and Kevin Dean
Country Inn At The Mall 936 Stillwater Ave Bangor, ME 04401 phone: 207 941-0200 fax: 207 942-1167 Sharon Liberty, General Manager	**Howard Johnson Inn** 336 Odlin Rd Bangor, ME 04401-6704 phone: 207 942-5251 fax: 207 942-4227 Bob Pauly, Manager
Days Inn 250 Odlin Road Bangor, ME 04401-6704 phone: 207 942-8272 fax: 207 942-1382	**Main Street Inn** 480 Main St Bangor, ME 04401-6237 phone: 207 942-5282 fax: 207 947-8733 Chiou Lin, Owner

Hotels/Motels (cont.)	
Motel 6 1100 Hammond St. Bangor, ME 04401 phone: 207 947-6921 fax: 207 941-8543 Andy Lord, Manager	**Riverside Inn** 495 State St Bangor, ME 04401-6609 phone: 207 973-4100 fax: 207 973-4110 Cindy Stockford, General Manager
Park-Rest Motel 236 Main Road S. Hampden, ME 04444-1205 phone: 207 862-5500 fax: not specified Karen Day	**Sheraton Four Points Hotel** 308 Godfrey Blvd. Bangor, ME 04401 phone: 207 947-6721 fax: 207 941-9761 Vivian Cammack, General Manager
Ramada Inn 357 Odlin Rd Bangor, ME 04401-6794 phone: 207 947-6961 fax: 207 945-9428 Free Martin, General Manager	**University Inn Academic Suites** 5 College Ave. Orono, ME Telephone: 866-4921 Fax: 866-4550 Tracey Richard, President
Ranger Inn 1476 Hammond Street Bangor, ME 04401 phone: 207 945-2932 fax: 207 945-3456 Joel Ranger	
Bed & Breakfasts	
High Lawn Bed & Breakfast 193 Main St Orono, ME 04473-1436 phone: 207 866-2272 or fax: not specified Betty Comstock, Owner	
Inns/Lodges	
Alamoosook Lodge P.O. Box 16 Soper Road Orland, ME 04472 phone: 207 469-6393 fax: 207 469-2528 Jan and Doug Gibson, Owners	**Lucerne Inn, The** RR 3 Box 540 Holden, ME 04429-9402 phone: 207 843-5123 fax: 207 843-6138 Bion Foster, Owner

AREA ATTRACTIONS

AREA EVENTS CALENDAR **947-5205**
The current calendar of seasonal events is produced by the Greater Bangor Convention and Visitors Bureau.
http://www.bangorcvb.org

BANGOR MUSEUM AND CENTER FOR HISTORY **942-5766**
Location: G.A.R. Memorial Building, 159 Union Street, Bangor. Hours: Tuesday–Friday, 10 am–4 pm June–December. Changing exhibits year round. This Greek Revival brick structure features interesting memorabilia of the region's past. The museum also offers The Best of Bangor, a guided bus tour through the city of Bangor. Guided tours of Mt. Hope Cemetery are given May – October. Call for special events and tour times. Cost: $4.00 adults. Children up to grade 12 and members free. Discounts available to AAA members and senior citizens.

BANGOR MUNICIPAL GOLF COURSE **945-9226**
Location: Webster Avenue, Bangor. Features: 18-hole, par 72, 6,500-yard course with driving range, caddies, carts, and snack bar. Home of the Greater Bangor Open and Bangor Daily News Amateur Tournament.

COLE LAND TRANSPORTATION MUSEUM **990-3600**
Location: 405 Perry Road, Junction of I-95 and I-395, Bangor. Hours: Monday–Sunday, May 1 – November 11, 9 am–5 pm. Collection of 19th and 20th century Maine land transportation vehicles—snowplows, wagons, cars, trucks, sleds, fire equipment and rail equipment—depicting how people and things moved by land in these eras. Location of WWII Veteran's Memorial for the State of Maine. All items have been used in Maine and donated by Maine people. Guided tours and a gift shop are featured.
Cost: $5.00 adults, $3.00 ages 62 and over, children under 19 free.

FIELDS POND NATURE CENTER THE MAINE AUDUBON SOCIETY **989-2591**
Location: 216 Fields Pond Road, Holden. Year-round programs, mini-classes and field trips that feature birding, frogs and salamanders, summer canoe trips, bat watches, fall hawk watches, geology walks, and winter tracking in snow. Contact: Judy Markowsky.

FORT KNOX **469-7719**
Location: Prospect — at the narrows between Prospect and Verona Island. Hours: Daily from 9 am – Sunset (May 1 – October 31). Daily tours Memorial Day Weekend through Labor Day Weekend. Group tours are available by prior request. One of the largest 19th-century forts in the United States.

ISAAC FARRAR MANSION SYMPHONY HOUSE MUSEUM **941-2808**
Location: 166 Union Street, Bangor, Maine. Constructed of imported English brick, mahogany from Santo Domingo, and slate from Bangor, Wales. This modified English Regency structure has housed noted playwrights, a law school, and the Northern Conservatory of Music. Call in advance for tour hours. Phone is answered at the YMCA—ask for Peggy Wentworth.

MAINE DISCOVERY MUSEUM **262-7200**
Location: 74 Main Street, Bangor. Hours: Tuesday–Saturday 9:30 am–5 pm. Open Sundays 11 am–5 pm. Closed Mondays. A great family experience. The largest hands-on museum north of Boston. Seven major interactive areas on three floors. More information at the website: www.mainediscoverymuseum.org
Cost: $5.50 for adults and children. Free for infants under 1 year. Discounted to $2.00 from 2–5 pm on Sunday.

MAINE FOREST AND LOGGING MUSEUM LEONARD'S MILLS **581-2871**
Location: In Bradley, just off Route 178. The museum is in the Penobscot Experimental Forest. Turn left onto the dirt road and proceed to the gate. Leonard's Mills, an authentic reconstruction of a self-sustaining logging and milling community of the 1790's. The public is invited to participate in a variety of activities or to enjoy marked hiking trails through the adjacent forest. Call for special events schedule. Hours: Daily dawn to dusk.

MAINE PUBLIC BROADCASTING CORPORATION **941-1010**
Television Channel 12 (Orono) and radio station WMEH 90.9. Location: 65 Texas Avenue, Bangor, Maine. Contact Person: Ed Fowler, tours by request.

MAP STORE **827-4511**
Location: 137A North Main Street, Old Town. Hours: Monday – Friday 9 am–5 pm; Saturday 9 am–4 pm. Extensive selection of state, U.S., and world maps, including raised relief maps, fishing depth maps, and nautical charts. Also guidebooks for bicycling/hiking/canoeing. Aerial photography can be arranged. Laminating is done on site.

OLD TOWN CANOE COMPANY **827-1530**
Location: 130 Main Street, Old Town. Hours: Monday – Saturday, 9 am–6 pm; Sunday, 10 am–3 pm. Features: Old Town Canoe Company (which also manufactures White Canoes), one of the largest canoe factories in the world, is famous for its high-quality and superbly designed canoes and boats. The factory store offers a 15-minute video which follows construction of a wooden canoe from beginning to end.

OLD TOWN MARINE MUSEUM **827-4567**
Location: Main Street, Old Town.
Hours: Monday – Saturday: 9 am–6 pm, Sunday: 10 am–3 pm.

OLD TOWN MUSEUM **827-7256**
Location: 138 South Main Street, Old Town.
Hours: 1–5 pm; June 11 – October 28, Wednesday – Sunday.
Founded in 1976, this museum offers several types of exhibits concerning the history of the community and its role in Maine's roaring lumber industry in the 19th century. The museum also offers a summer schedule of Sunday programs. Cost: Free.

PAUL BUNYAN STATUE
Location: Main Street, Bangor, in front of the Bangor Auditorium. The 31-foot-tall statue of the mythical lumberjack who was born in Bangor in 1834. A gift to the city from its citizens on Bangor's 125th anniversary.

PENOBSCOT INDIAN RESERVATION AND MUSEUM **827-4153**
Location: Indian Island, Old Town. Museum hours: Monday – Thursday, 12–5 pm; Saturday & Sunday, 10 am–2 pm. Group tours available daily with 72-hour notice by calling James Neptune at 827-4153. Cost: $1.00/person for tour groups or individual donation. Visitors will find superbly crafted woven baskets and leather goods, as well as a taste of Penobscot customs.

WEBSTER PARK
Location: North Main Street, Orono. A popular place for picnics, wading, and canoe launching.

PUBLICATION OF CONFERENCE SERVICES DIVISION, THE UNIVERSITY OF MAINE, TEL: 207-581-4092 SUMMER 2002

LEARNERS, LAPTOPS AND POWERFUL IDEAS:
The First Maine International Conference
on Learning with Technology
The University of Maine, Orono, Maine
August 14th-16th, 2002
In coordination with the Maine Learning and Technologies Initiative

For complete conference information, please visit the conference web site at: www.agent.maine.edu/laptop/ or contact Tom Bickford, conference coordinator at (207) 581-2012 or bickford@agent.maine.edu

This August, the University of Maine will be hosting a landmark conference addressing issues relating to the 1-to-1 computer environment in education.

This education conference has something for teachers, administrators, school board members, parents, technology coordinators, and even students. This exciting event is a prelude to the September 2002 launch of the Maine laptop initiative in which every seventh and eighth grade public school student will be issued a laptop computer. The two and a half-day conference will showcase five "firsts" in the evolution of the principle of a personal computer for every student:

* The Maine Learning and Technologies Initiative, the first state in the world to enact a law providing every seventh and eighth grade student and teacher with a personal computer.
* David Loader of Australia, principal of the first school to adopt one-to-one portable computing (1989)
* Stephen Costa of Australia, probably the first teacher in the world to lead a laptop classroom (1989)
* Alan Kay, the first scientist to describe a laptop computer (1968) and pioneered the idea of the graphical user interface (GUI) that led to the Apple and Windows operating systems.
* Seymour Papert, Professor Emeritus at the Massachusetts Institute of Technology (recently named by Newsweek as one of ten national innovators in education) and the first educator to advocate the use of personal computers in learning (1968)

Teachers from around the world and every Maine school district are invited to the conference to join internationally respected experts to discuss aspects of education and transformational change with personal computers. The conference features plenary sessions, panel discussions, hands-on workshops and presentations on historic precedent, lessons learned from classrooms in Australia and Costa Rica.

A balance between technological innovation and practical classroom concerns will be addressed in order to prepare teachers facing this historic chapter in education. Teachers and students in the forefront of learning with technology will focus on topics such as:

* Curriculum and learning with personal computers and laptops in ALL fields - the humanities, sciences, mathematics and the arts
* Teacher Professional Development
* Diversity in Education and Technology
* Public and policy support - educating parents, teachers, administrators, school boards, city councils, the media, and elected officials about the power and potential for Maine education and economic opportunity
* Nuts and Bolts - translations and transformations in the classroom and school - including issues of computer/laptop care, security, trouble-shooting and classroom organization

At least three pre-conference workshops will be held on August 13th and 14th providing in-depth use of multimedia and iMovie, the LEGO MindStorms Robotic Invention System, and the StarLogo programming system.

Learners, Laptops and Powerful Ideas: The First Maine International Conference on Learning with Technology is sponsored by the University of Maine Computer Science and Mathematics Department and its Agent Institute in collaboration with the Seymour Papert Institute of Blue Hill The Learning Barn and the MIT Media Lab.

Sixth International Conference On Computer Based Learning in Science (CBLIS)

University of Cyprus, Nicosia, Cyprus
5 - 10 July 2003

For complete conference information, please visit the web site at: http://www.ucy.ac.cy/cblis2003

CALL FOR PAPERS (Deadline 10th September 2002)

INTRODUCTION

Computer Based Learning (CBL) is regarded as having great potential for enhancing the quality and effectiveness of education. Computers have been employed in teaching for over thirty years, but their use still plays only a minor role in most school science programs as well as in most undergraduate and postgraduate courses in mathematics, science and engineering. At present, there are many software packages available for simulation, intelligent tutoring, mathematical modeling, static and dynamic book emulation and visualization algorithms. There also many web-based learning environments that make use of innovative technologies which have the capability to revolutionalize both the process of constructing meaning and the development of scientific thinking. The CBLIS community is committed to the promotion of innovative learning environments for the benefit of the wider scientific community. CBLIS conferences are organized on a biennial basis with the aim of showcasing current research trends in designing learning environments and benchmarking best practice.

CONFERENCE OBJECTIVES

The conference will provide a forum for the assimilation of views from researchers in the education, philosophy and psychology communities. These contributions will serve as a focus for continued development of computer-based learning environments in the fields of mathematics, physics, chemistry, computer science and engineering. Cross fertilization of ideas between these branches of science will be encouraged by keynote addresses on educational, philosophical and cognitive aspects of CBL. While specialist presentations will deal with the latest developments in specific areas of science, the broader contributions from each discipline may be integrated to form a powerful set of strategies for CBL in the future.

KEYNOTE SPEAKERS

- Celia Hoyles, Institute of Education
- Yasmin Kafai, UCLA
- Gerald W. Meisner, University of North Carolina, Greensboro
- Bill Sandoval, UCLA
- Uri Wilensky, Northwestern University

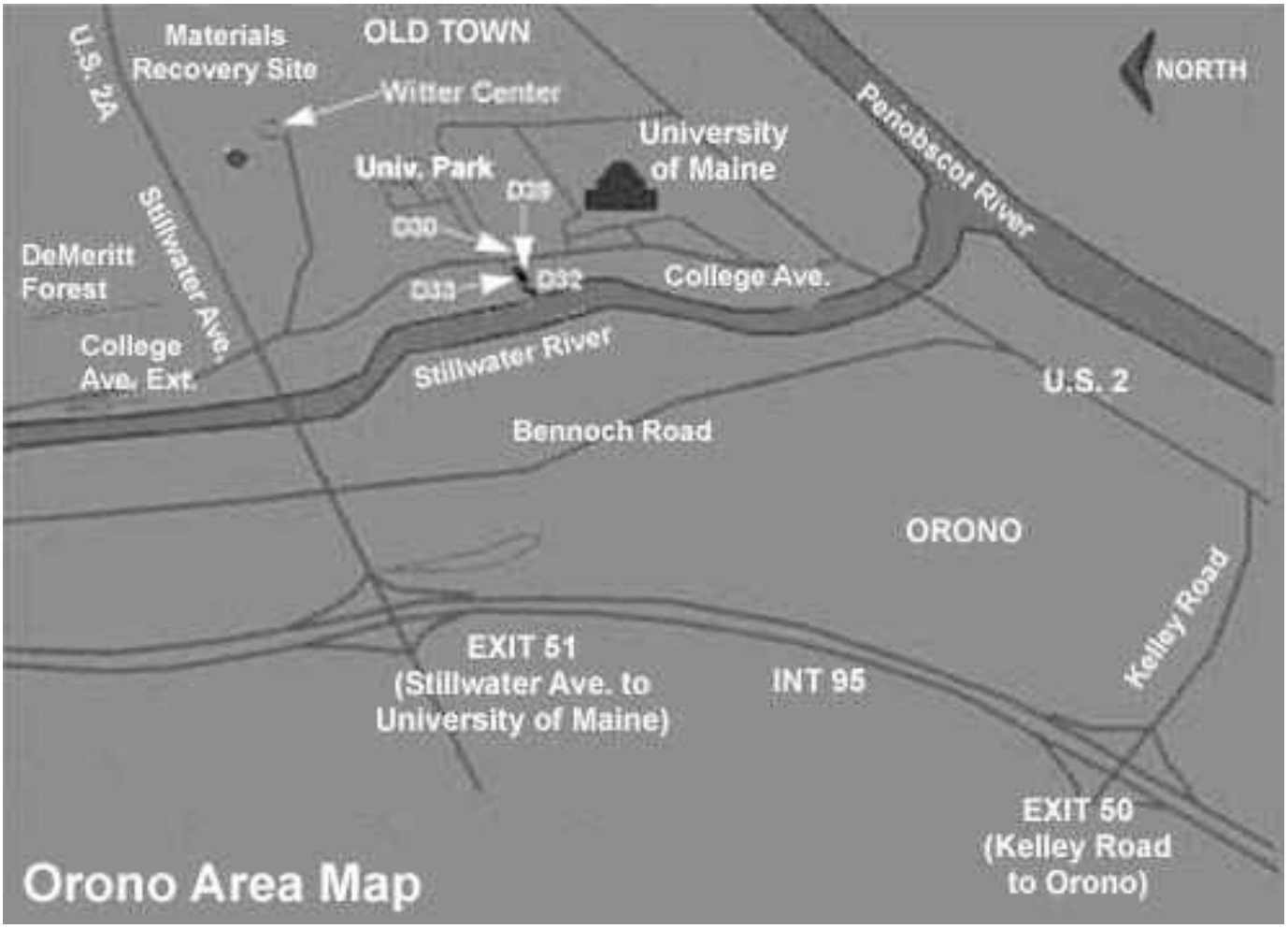
CONFERENCE TOPIC AREAS

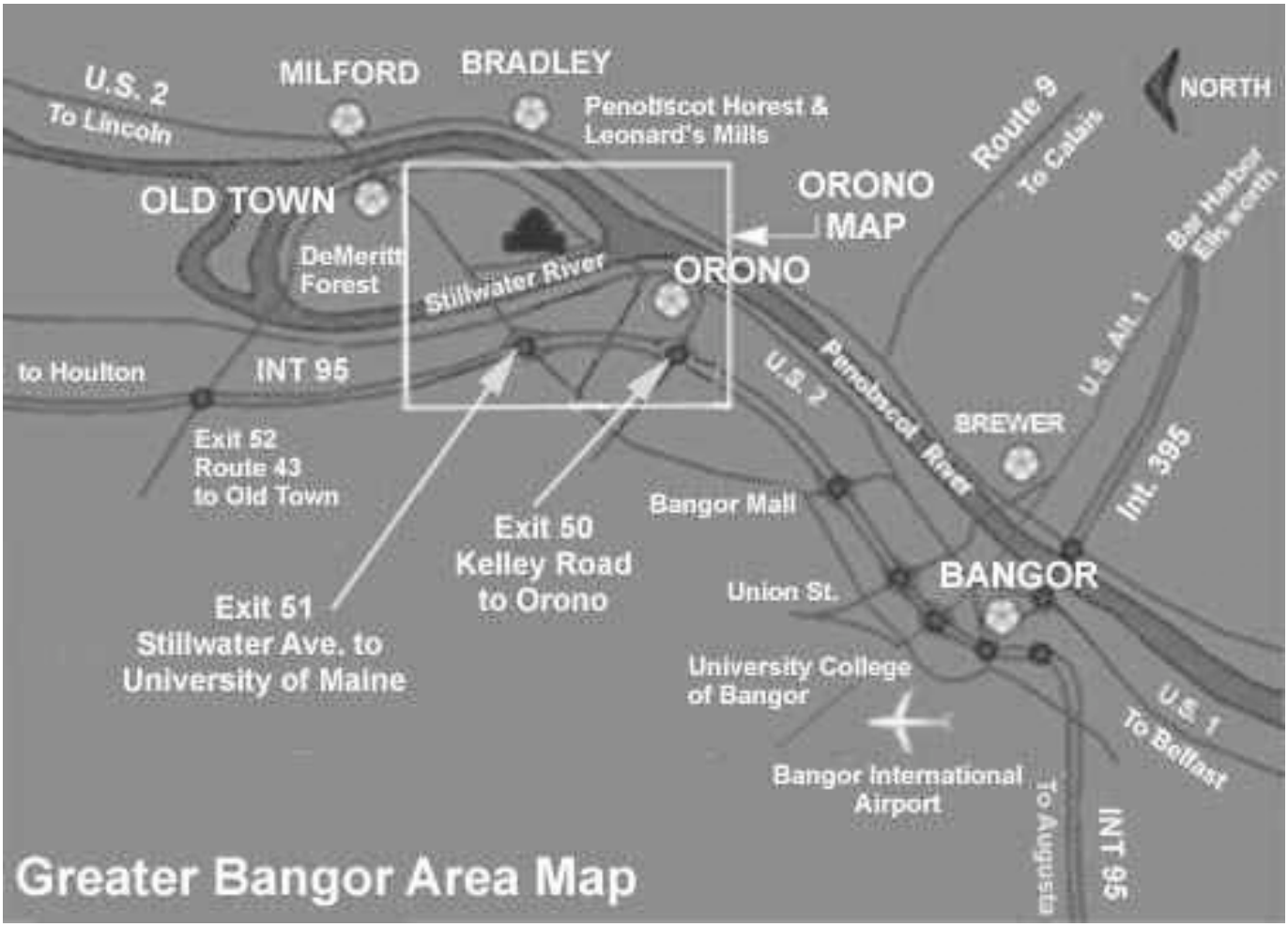
- Teaching and Learning in Science
- Approaches to the use of Communication and Information Tools in Education
- Monitoring and Evaluation of Performance
- Intelligent Software
- Human Computer Interface Issues
- Learning Environments
- Software Quality and Standards
- Virtual Reality and Virtual Laboratories for Science Learning
- Multimedia Approaches
- Distributed and Network Based Learning
- Review papers

- PROGRAM FOR TEACHERS -

On Monday 5th and Tuesday 6th July, a special program for school teachers will take place parallel to the main conference. Interested delegates are invited to organize a workshop for this program.

Area Maps


Materials
Recovery Site
OLD TOWN
Witter Center
U.S. 2A
NORTH
Penobscot River
University
of Maine
Univ. Park
D29
D30
D31
D32
College Ave.
DeMeritt
Forest
Stillwater Ave.
College
Ave. Ext.
Stillwater River
U.S. 2
Bennoch Road
ORONO
Kelley Road
EXIT 51
(Stillwater Ave. to
University of Maine)
INT 95
EXIT 50
(Kelley Road
to Orono)
Orono Area Map


U.S. 2
To Lincoln
MILFORD
BRADLEY
Penobscot Horest &
Leonard's Mills
NORTH
Route 9
To Calais
OLD TOWN
ORONO
MAP
DeMeritt
Forest
Stillwater River
ORONO
Bar Harbor
Ellsworth
U.S. Alt. 1
to Houlton
INT 95
U.S. 2
Penobscot River
BREWER
Exit 52
Route 43
to Old Town
Int. 395
Bangor Mall
Exit 50
Kelley Road
to Orono
BANGOR
Union St.
Exit 51
Stillwater Ave. to
University of Maine
University College
of Bangor
U.S. 1
To Bellast
Bangor International
Airport
To Augusta
INT 95
Greater Bangor Area Map