



**The Future We Create: Science Education for a Scientifically Literate Future
Third Annual SENCER New England Symposium**

**January 8-9, 2008
Southern Connecticut State University**

AGENDA

12:00-1:00 ***Registration and Luncheon – Adanti Student Center Theatre***

1:00-1:45 ***Symposium Welcome – Adanti Student Center Theatre***

Cheryl Norton, President, Southern Connecticut State University
Selase Williams, Provost, Southern Connecticut State University
DonnaJean Fredeen, Dean of Arts and Sciences, Southern Connecticut State University
David Burns, Executive Director, National Center for Science and Civic Engagement (NCSCE)

2:00-3:00 ***Concurrent Session 1 (30-minute Formal Papers)***

ASC 305 **Science Education/Literacy**

Roxane Johnson, The Fulcrum Institute for Leadership in Science Education, Tufts University
Improving K-8 Teacher Pedagogical Science Content Knowledge Through Investigations and Online Discussions: A Possible Model for Schools of Teacher Education

The Fulcrum Institute for Leadership in Science Education engages cohorts of K-8 teachers with challenging science content through a model that deepens both science content and pedagogical knowledge. Through a series of three online courses and a weeklong summer institute, the teachers move from working with macroscopic models to microscopic models of properties of matter as well as learn how children learn science through inquiry and what teaching strategies support inquiry learning. There are three main learning components to the courses: (a) learning science content through investigation (b) becoming familiar with a model of children's learning science through inquiry, and (c) planning and carrying out an inquiry science investigation in the classroom. Participants rely on a web-based environment for online communication, collaboration, scientific research and access to electronic resources. This model of engaging teachers in both deep content learning and research about children's learning in science can be used successfully in other teacher education programs.

Sally Hoskins and **Leslie Stevens**, City College of New York and University of Texas, Austin
Demystifying research science and humanizing researchers through intensive exploration of science writing—the C.R.E.A.T.E. method.

The C.R.E.A.T.E. method (Consider, Read, Elucidate hypotheses, Analyze data, and Think of the next Experiment) is a new and cost-effective approach to teaching and learning that brings the excitement and creativity of science research to the classroom. Students read a series of published journal or newspaper articles that follow the development of a scientific idea. Using novel pedagogical tools, students examine

the significance of published data, ultimately designing their own follow-up experiments which are vetted in “peer grant panels”, modeling real science. Students also communicate with authors by email, getting their own questions answered. The method, which is adaptable for high school or general education level, improves critical thinking and increases enthusiasm for science. Thanks to NSF for support.

ASC 306 **Math Education**

Marina Dedlovskaya and **Patricia Sokolski**, LaGuardia Community College

Raising Awareness: Intro to Algebra, Critical Thinking, and the Environment. This presentation will discuss two projects done in a learning community consisting of Introduction to Algebra and Critical Thinking and exploring environmental issues. We will show how our students were able to integrate mathematical concepts and critical thinking to evaluate the impact of our behavior on the environment and think about strategies to implement more eco-friendly habits for ourselves, our communities, and our college in particular.

Prabha Betne, LaGuardia Community College

SENCER Approach in Basic Math

This presentation will discuss activities and projects done in Basic Skill math class, Math 095 (Introduction to Algebra) at the LaGuardia Community College. The activities are developed around a common theme of environment. Through the activities students apply knowledge of math to understand the environmental issues, such as climate change, energy consumption, and green house effect. Students performed mathematical calculations to estimate the impact of our consumption habits on the environment and think about actions that can be taken in our daily lives to reduce such impact. Specific activities and student responses will be discussed.

3:00-3:15 ***Break***

3:15-4:15 ***Concurrent Session 2 (30-minute Formal Papers)***

ASC 305 **Biological Sciences and Community-Based Research**

Yasser Hassebo, LaGuardia Community College, City University of New York

Mathematics in Contexts: Implementing Mathematics to Ecological Science

Most mathematics courses have a problem-solving approach that emphasizes the importance of mathematical reasoning and modeling in solving real-world problems, drawn from a variety of disciplines. Because of the wide range of these problems, getting students to focus their attention for the entire class period is a challenge. Except in the most advanced mathematics classes, presenting the material in such a way that is easy to visualize and that helps students grasp disparate concepts is also considerable challenge. However, I believe that this goal can be accomplished through numerous pedagogical methods including the use of compelling “live” problems drawn from environmental issues

Jennifer H. Mattei and **Mark A. Beekey**, Sacred Heart University

Project Limulus: Lessons Learned from the Development and Execution of a Community-Based Research Project

Project *Limulus* is a community-based research program investigating the population dynamics of horseshoe crabs in Long Island Sound. This project is community based because it includes Federal and State environmental regulators, non-profit environmental organizations, local representatives from national businesses, K-12 students and teachers, and undergraduate/ graduate students and their professors. Project *Limulus* allows students of all ages to experience science as a process while also providing invaluable data for horseshoe crab management. We present lessons learned over the past six years with respect to establishing community-based research projects, educational impact, and maintaining scientific rigor.

ASC 306 **Physical Sciences and Teacher Education**

Karen Cummings and **James Dolan**, Southern Connecticut State University

Making Physics Relevant to Pre-Service Elementary School Teachers

Faculty at Southern Connecticut State University have designed a physics course specifically for Pre-service elementary teachers. In this course, students gain the pedagogical content knowledge they require. All content is presented through hands-on activities making use of materials available in typical classrooms. Only content tied to K-6 science standards is presented. The result is a course in which the students learn physics, enjoy doing science and view as highly relevant. In this talk we will present an overview of the course and measures of student learning and shifts in attitudes towards science.

Andria C. Schwartz and **Robert A. Gutermuth**, Quinsigamond Community College, Harvard-Smithsonian CfA

Active Astronomy: Curriculum Development with the Spitzer Space Telescope

We have begun a program of web-based Astronomy curriculum development based in part on current star formation research using the Spitzer Space Telescope. Our goal is to find new ways to bring new and exciting research into K-13 classrooms, both for use as a teaching tool and for creating broader interest in research science. This project has led to curriculum development at Prof. Schwartz's parent institute, and in the future we will build a funding base for development of web-based lesson plans and tools. See <http://www.qcc.mass.edu/aschwartz/Externship2006/>.

4:15-4:30 **Break**

4:30-5:00 **Concurrent Session 3 (30-minute Formal Papers)**

ASC 305

Sarah Kenick, University of New Hampshire Manchester

Greening Organic Chemistry: A Study to Investigate the Effect of the Teaching of Green Chemistry on Students' Critical Thinking Abilities and Attitudes About Science

The one semester Organic Chemistry course is typically one that employs some of the most hazardous chemicals that students majoring in the life sciences will come across in the typical college curriculum. Recent advances in the field of Green Chemistry prompted a look at "greening" the organic chemistry laboratory sequence at UNH Manchester in 2006. This presentation will briefly discuss the series of events that led to infusing the teaching and practice of Green Chemistry into this course, and results regarding this effect on student learning. An overview of Green Chemistry principles, practice, and resources will also be briefly discussed.

ASC 306

Melissa Robinson and **Robert Shreve**, University of Tennessee Health Science Center

Coordinating Training Workshops and Follow-Up Programs for Science Teachers: Planning Ahead for Success

Organizing workshops for public school science teachers presents many challenges from initial recruitment to managing the schedule to post-workshop follow-up. This workshop will provide information on successfully recruiting teachers, coordinating workshop speakers, determining format and content, selecting locations for the workshop, determining appropriate promotional items, preparing handout materials, coordinating catering, and many more aspects of planning a quality teacher training workshop. Additionally, the workshop will provide information on planning meaningful follow-up programs, providing feedback to teachers, and assisting them with transitioning their new knowledge into the classroom. Many example materials will be distributed during the session.

ASC 308

Suzanne Conklin, Rhode Island College

A Trade Book Can Open Students' Eyes to Science-Society Connections: An Anecdotal Account

Recently, in an honors section of a non-majors introductory biology course, a trade book describing the poisoning of a Montana mining town was added to the curriculum with surprising results. Students were engaged in the course in multiple ways, which was profoundly demonstrated by a new awareness of the links between government, business, citizen advocates, biology, geology, medicine, and themselves. Possible successful elements included student choice in the project and the instructor's lack of prior knowledge on the subject. This presentation will include a semester synopsis and discussion of how this strategy could be improved and modified for other courses.

5:15-6:00 **Poster Session – Adanti Student Center Theatre**

Peter Nielson, Keene State College

Keene State College Geoscience Courses: Fostering Science Literacy

Keene State College implemented an outcomes based Integrative Studies Program in fall 2007. All courses in the program must identify outcomes in three areas – skills, perspectives and integrative outcomes. Science outcomes include an understanding of the scientific method and its application and how science influences our views of the world. The Geology Department at Keene State College has designed courses for non-science majors that are much more likely to engage students than the traditional "introduction to the major" that is information dense and may turn a student away from an appreciation of being scientifically literate. We seek to engage students with topics that directly affect them in their daily lives and that can enable them to make reasoned choices in the future. Course descriptions and outcomes will be shared.

Ann Maher and Kristy Kenyon, Teacher And Learner Partnership/Hobart and William Smith Colleges
The Power of Questions – Assuring Every Learner a Voice

Every science teacher aspires to develop critical thinking skills in students. Promoting high level thinking, we know, drives successful instruction and promotes mastery learning. But how is it accomplished? Is learning linear or cyclical? How can more students become motivated to pursue deeper understanding? This presentation will give educators practical charts, tools, and resources to enhance reflective practice and motivate learners. Using Bloom's Taxonomy as the theoretical base, ways to engage students through inquiry and divergent thinking will be explored. Interdisciplinary connections bridging content at all educational levels will be highlighted.

Ann Maher, Teacher And Learner Partnership

Moving Education into the Twenty-first Century

"The future belongs to a very different kind of person –creators and empathizers, pattern recognizers, and meaning makers" (Daniel Pink, *A Whole New Mind*). In this book, Daniel Pink analyzes in detail the social and economic forces driving our global economy, and articulates what is needed for success in today's world. His message is contemporary and compelling, with important and positive implications for our educational system. This presentation will provide an overview of Pink's ideas, and suggest concrete steps that can be taken to infuse these ideas into science instruction and teacher training.

Frank Catano, Kevin Degnan, Eleanor Dunfey-Freiburger, Karen Erickson, Southern New Hampshire University

Course Model: G.R.E.E.D. Globally Responsible Environmental and Economic Decisions

We present part 2 of this course on how nature sustains life, how human behavior is destructive of life, and what a sustainable society looks like.

Brian E. Hagenbuch, Robert Sanford, Nora Bynum, Christine Engels, and Eleanor Sterling.

American Museum of Natural History

A Multi-Tiered Assessment Framework for Biodiversity Education

The Network of Conservation Educators and Practitioners (NCEP) is a global biodiversity conservation initiative creating opportunities for the broad exchange of information and strategies among educators and practitioners. NCEP has created over sixty web-based curricular modules on biodiversity topics that emphasize active learning pedagogies and the application of critical thinking to conservation problems. To complement the modules, we developed a multi-tiered assessment framework that evaluates 1) content knowledge before and after using the modules, 2) student confidence in their knowledge of biodiversity, 3) interest in biodiversity topics, 4) development of process skills important for conservation, and 5) changes in worldview and environmental orientation. Our poster highlights NCEP's comprehensive approach to conservation education, our implementation of modules and assessments, and our efforts to improve scientific literacy.

6:00-7:00 ***Dinner – Adanti Student Center Theatre***

7:00 – 8:00 **Keynote Address – Adanti Student Center Theatre**

The Future We Create: Science Education and the View from NSF

Karen Kashmanian Oates, Deputy Division Director, National Science Foundation,
Education and Human Resources Directorate, Division of Undergraduate Education

Wednesday Schedule

7:30-8:30 ***Breakfast Buffet at SCSU – Adanti Student Center Theatre***

8:30-9:30 ***Opening Remarks – Adanti Student Center Theatre***

Brian Hagenbuch, Holyoke Community College/Hartwick College

Plenary: Creating a Campus Climate for SENCER

**DonnaJean Fredeen, Southern Connecticut State University and Robert Sanford,
University of Southern Maine**

Rome was not built in a day and at times getting faculty, administrators, and students to embrace the ideals of SENCER may seem to take longer. How do faculty and administrators advocate for and implement the ideals of SENCER? The intent of this plenary is to discuss a few strategies which have created a growing acceptance of SENCER on two campuses and among stakeholders with highly independent minds. Discussion will center around facilitating a change in culture, hiring practices, and reward systems. We hope to encourage a network of support among campus leaders wanting to implement SENCER in their curriculum.

9:30-9:45 ***Break***

9:45-11:00 ***Panels and Workshops (75-minutes)***

ASC 305 Information Literacy

Linda J Tsoumas, Bridget Gunn, Christopher Bigelow, and Zenobia Lojewska, Springfield College
Information Literacy in the Sciences: Our Path to Success

Information literacy is an essential component of undergraduate and graduate education and is defined within accreditation standards. Building a comprehensive and progressive information literacy curriculum is challenging and this panel presents the experience of one college, detailing the development and implementation of an information literacy curriculum, related student assignments, outcome assessment, and faculty and library staff roles. Our experience began with initial grant funding, followed by curricular

revision and development, and today the curricular infusion of information literacy is spreading across the campus with a current focus on the sciences.

ASC 306 **Designing a SENCER Course**

Vincent Breslin and **James Tait**, Southern Connecticut State University

Evolution of a SENCER Course: Effective Teaching Strategies to Maximize Student Learning

The authors have developed and taught the Honors College SENCER course Science along the Connecticut Coastline on five occasions since Fall 2002. The course combines field-based research and guided inquiry focused on the Connecticut coast and Long Island Sound. The course was designed to teach science to non-majors by formulating hypotheses, collecting field samples and data, using modern analytical instrumentation in a laboratory setting, subjecting data to quantitative analysis, communicating results in writing and orally, and by stressing the societal relevance of the investigation. The authors will briefly describe the evolution of the course content and teaching methods over the years and their effect on student learning. The authors will invite workshop participants to share and discuss their own strategies and pedagogies for teaching science to both science and non-science majors.

ASC 308 **Science Teacher Preparation**

Susan Cusato, Southern Connecticut State University

Re-Thinking Science Preparation for Elementary and Secondary Teachers

Most university teacher preparation and professional development programs offer science content courses in a traditional lecture and laboratory setting. Current research in the learning of science suggests that students learn best by becoming actively engaged in hands-on inquiry based investigations, discussions and activities related to the nature of science and in experiences that help them develop their own conceptual framework for understanding science. This workshop presents two courses designed around the SENCER philosophy specifically for elementary and secondary teachers. (Integrated Science Experience and The Historical Dimensions of Scientific Thought)

ASC 309 **Global Warming in the Classroom**

Roxane Johnson, The Fulcrum Institute for Leadership in Science Education, Tufts University

Beyond the Visible: Building an Understanding of Global Warming through Investigations and Discussions about Heat Transfer

This workshop will model classroom-teaching techniques that build understanding: formative assessment, sharing predictions, investigating phenomena, collaborative model-building, discussing with peers, and reflecting on learning. The phenomena to be investigated will deal primarily with the science behind the greenhouse effect by investigating basic principles of radiation. Participants will collect data using probes, compare models, and engage in collaborative discussions to build understanding. These investigations and practices are part of the Fulcrum Institute for Leadership in Science curriculum developed by Tufts University physicists and TERC curriculum developers.

11:00-11:15 **Break**

11:15-12:15 ***The Future We Create: Discussion and Planning Sessions***

Each of these sessions is designed as a roundtable discussion on one of the larger issues SENCER is attempting to address. Perhaps you are experienced in the topic, have questions about it, or are interested in pursuing it at a deeper level. These sessions are designed to not only help participants in their own work, but also aid SENCER in creating an agenda to pursue these topics.

ASC 305 **SENCER in Theory and Practice: An Introduction and Orientation** (intended for people new to SENCER, especially those interested in applying for the 2008 Summer Institute)

Facilitator: **David Burns, National Center for Science and Civic Engagement**

This session is designed for participants who wish to learn more about the SENCER program, its origins, goals, accomplishments, and the theories and ideas that lie behind it. The session will also identify and explore challenges that can arise when implementing SENCER courses. An overview of the approach will be presented in the form of a rubric. This should enable participants to consider how the approach can be applied to subject areas in STEM disciplines as well as others, and explore strategies for implementation. A brief presentation will be followed by informal discussion session.

ASC 306 **Curriculum Change, Teacher Preparation and K-16 Science Education**

Facilitator: **Adrienne Wootters, Massachusetts College of Liberal Arts**

Some students at our colleges and universities will take SENCER-ized courses, but many will not. A few will have active learning processes modeled for them, including inquiry-based learning. Most courses, however, are offered in the traditional lecture format. What does this mean for our undergraduates? From our vantage point, it looks like whether a future teacher will have the tools to model inquiry-based learning techniques for his or her own students is dependent on a roll of the dice. This discussion will be centered about curriculum change: What changes in curriculum and outcomes are necessary and possible in order to achieve the goal of 100% pre-service teacher preparation in science? What kind of general education experience should undergraduate non-science majors have so that any one of them would be prepared to teach elementary school science? Are we modeling active learning and assessment for our science majors who will become middle- and high school teachers? Participants are encouraged to bring materials that have helped them with this question in their own courses and programs.

ASC 308 **Spaces for Science: Creating Learning Environments for Science**

Facilitator: **L. Kraig Steffen, Fairfield University**

Must laboratory be in a lab? Can the classroom become a Lab? How can we create environments for teaching science that encourage students to explore the world around them? What kind of lecture/laboratory teaching space makes the best sense for general science courses? Come and join a conversation about teaching spaces for the sciences. We are in the early design stages for a new classroom - laboratory space dedicated to core science courses. Do you have dedicated laboratory space for non-majors science courses? Do you do in-class Laboratory exercises? How can new technology best be used in teaching laboratories? Do you have an exciting new way to use document cameras, laptops, or smartboards in a laboratory setting? Come and share your experiences about creating innovative and useful spaces for teaching, and learning, science.

ASC 309 **How Do We Know Any of this Works?—The Challenge of Assessing Learning**

Facilitators: **Eliza Jane Reilly, Senior Scholar, SENCER, and Brian E. Hagenbuch, Senior Associate, SENCER**

Serious would-be educational reformers have always been interested in knowing if the innovations they are embracing are “working.” Given the intensified interest of accrediting bodies in measuring learning outcomes however, these days everyone involved in the teaching enterprise is expected to be able to give credible answers to critical assessment questions. This session will offer a brief overview the assessment and evaluation strategies developed in connection with the SENCER project, review findings concerning the efficacy of the SENCER approach, and identify opportunities for participants to become involved in SENCER-sponsored assessment efforts. All participants will be invited to share their own experiences and thoughts regarding assessment challenges (such as establishing clear learning goals) and strategies (such as aligning measurement and pedagogy). Questions to be considered include: How do we help students know both what they are learning and what helps them learn? What kinds of evidence are required to assure ourselves and our colleagues that specific pedagogical strategies are working? How can we measure “knowledge transfer”? What can SENCER and other national or regional programs do to help?

12:30-1:00 *Discussion Session Presentations/Comments–Adanti Student Center Theatre*
Facilitators: Robert Sanford and Brian Hagenbuch, Co-Directors SENCER Center for Innovation-
New England

The groups that met during the previous session will present out the key findings from their discussions.

1:00 *End of Session: Box Lunches Provided*

Box lunches provided by the NSF, MRSEC and CRISP collaborative program between SCSU, Brookhaven National labs, and Yale University.

*** The SENCER Center for Innovation (SCI)—New England was recently created at the University of Southern Maine. SCI-NE facilitates information transfer, meetings, and other SENCER activities in the New England Region. We welcome your participation in this effort. You are invited to stay and discuss the development and implementation of the SENCER SCI-New England regional network and activities after the conclusion of the formal symposium.*

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Science Education for New Civic Engagements and Responsibilities (www.sencer.net)

SENCER Center for Innovation (SCI)—New England at the University of Southern Maine

National Center for Science and Civic Engagement (www.ncsce.net)

Harrisburg University of Science and Technology (www.harrisburgu.net)

