Making the Broader Impacts in K-12 Science Education

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Messages

• We will all succeed or fail together in making US science and technology successful (chemists, physicists, mathematicians, engineers, educators, ....)

• There are many opportunities for the university to engage with K-12 science education

• K-12 education deserves the same quality of thought and effort that our research and teaching do.

• Description of one particular sustained engagement - The Science House at North Carolina State University
Broader Impacts

National Science Foundation employs two criteria in the merit review of proposals: What is the intellectual merit of the proposed activity? What are the broader impacts of the proposed activity?

• Advance discovery and understanding while promoting teaching, training, and learning
• Broaden participation of under-represented groups
• Enhance infrastructure for research and education
• Broaden dissemination to enhance scientific and technological understanding
• Benefits to society

It’s a Tough World For Science

Didn’t my students learn anything in high school?
Why can’t I hire the qualified technical staff that I need?
Why does the public disagree with my views on (stem cells, global warming, the International Space Station,…)?
Why can’t we attract new technology-based industries to our country?
Congress seems to have forgotten science and technology.

Does anyone understand MY needs?
Goals of K-12 Education Engagement

- Improve K-12 science and mathematics education
- Encourage a larger and more diverse group of students into science careers
- Enhance the science literacy of the general public
- True engagement changes scientists and the university
What Does Engagement Look Like?
What Does Engagement Look Like?

Attracts your attention
Makes you react
Takes unexpected forms
Messy
Fun
Builds your circle of friends
You learn together
No one has all the answers
How Do You Stay Engaged?

- By meeting your own needs and making an impact on others
- By supporting the goals of your campus or business
  - Undergraduate teaching
  - Research
  - National recognition
  - External funding
Scientists bring to K-12 education an abiding interest and fundamental knowledge of science and the scientific process.

How can we put those qualities to the best uses?
Roles for Scientists in K-12

Resource
Partner
Advocate
Resource -> Partner -> Advocate

• Visit some schools to recruit students
• Demonstration programs for teachers
• Science course for teachers
• Science on the Road demonstrations
• Science teaching conferences
• Science teaching publications
• Collaboration on teacher training proposals and programs
• Membership in education organizations
• Education boards and commissions
• Leading K-12 Education Outreach programs
• Helping other scientists do the same
What Motivates Scientists in K-12?

- Federal research funding initiatives
- The need for scientists in the future
- Our own children
- Concern for the public welfare
- Fun
How Can We Make a Difference?

- Alignment with K-12 goals
- Understanding of K-12 Issues
- Partnerships and Leverage
- Personal Interactions (Politics)
- Quality
How Do We Keep It Going?

• Alignment with institutional goals
• External funding
• Impact on recruiting of students
• Impact on teacher training
• Enhancement of university student opportunities
• Scholarly activity
• Engagement with the community
The Science House
NC State University

- Our mission is to partner with K-12 teachers to increase student enthusiasm for science and mathematics by promoting hands-on inquiry-based learning activities.
The Science House - NC State University

• Founded in 1991 by Dean of College of Physical and Mathematical Sciences (a chemist)
• Director from the science faculty/ Teacher co-Director
• Collaborations with all NCSU Colleges, including Education, and many UNC campuses
• College support and external partnerships
• Presently about 13 full-time staff, 6 offices, numerous part-timers
• Reaches about 3,000 teachers and 20,000 students per year
• Emphasis on rural schools and underrepresented groups
• Programs in NC, VA, SC, TX, GA, KY, AZ, IN
Student Science Programs

Teacher Training

Curriculum Development and Dissemination
Teaching With Technology
Rural Schools Programs
Countertop Chemistry
Physics from the Junk Drawer
K-5 Inquiry
Teacher Pioneers
Math and Science Partnerships

Teacher Training

[Image of people in a laboratory setting]
Student Science Programs

Envirotech Camps
Girl Scout Science Camps
Expanding Your Horizons
Imhotep Academy
Photonics Explorers
Photonics Leaders
Girls Collaboratives
Outreach from NSF Center for Environmentally Responsible Solvents and Processes

Outreach from NSF Rice Blast Genomics Project

Conferences on K-12 Outreach

High-volume Web Site

Curriculum Development and Dissemination
Science on the Road  We Go Anywhere!

Chemistry

Physics
Teaching with Computer- and Calculator-based Laboratory Equipment
The “Imhotep Continuum”

- Imhotep Academy (MS)
- Algebra Camps (MS)
- Photonics Xplorers (9-10)
- Photonics Leaders (11-12)
The Bennett's Millpond Project is a new collaborative program for aquatic environmental learning partnering The Science House, the Albemarle Learning Center, Chowan County, and NC State University. This program will focus on studying the environment of an unusual and historic space, the colonial-era Bennett's Millpond near Eden, NC. The Millpond and the surrounding area are considered a coastal swamp and have not previously been studied. Research and data collected will include water quality (chemical, physical, and biological), hydrology of the area, meteorology, and aquatic and terrestrial flora and fauna.

See photos of the Hurricane Isabel's impact on the Millpond in September 2003

Two years after Hurricane Isabel - a new look for Bennett's Millpond

This project is funded by a grant from the Howard Hughes Medical Institute with additional support from the Golden Leaf Foundation.
Expanding Your Horizons/
National Girls Collaborative
Outreach from NSF Center for Environmentally Responsible Solvents and Processes

- Teacher Training Programs (NC, TX, GA)
- Curriculum Development
- Scientists in the Classroom
- Focus on a Scientist website
Benefits to Our Partners

- Better qualified teachers
- More laboratory teaching
- More investment in laboratory equipment
- Science expertise
- Students motivated to learn science
Importance to Our University

- Enhance NC K-12 education
- Provide outreach functions for research programs
- Recruit students
- National recognition
- Public relations across the state
- Better undergraduate teaching
What The Science House Does That Benefits University Scientists

- Education about K-12 education
- Help the scientists succeed with K-12
- Help the scientists get credit for their efforts
- Build scientist communities for K-12 engagement
- Connecting to K-12 schools, programs
- Support for Broader Impacts projects - small and large
How does a Science House keep going?

- Administrative buy-in
- Clear mission
- Entrepreneurship
- Rigorous goals and standards
- Disciplinary ecumenicism
- A faculty constituency
- Partnerships, partnerships, partnerships.....
Lessons Learned: What Worked

- We became engaged: a part of the education community
- We found a niche - science and technology expertise
- Doing the research about education
- Sensitive to the university agenda
- Enthusiasm for science
- High quality programs
Teaching Staff at The Science House

• Mostly former teachers
• Almost all have science degrees
• Close links to communities
• Assets as important as the buildings and programs
What We Have Learned:
*It turned out just like we planned*

- Hands-on science and math
- Opportunities for students
- Partnership with teachers
- Science faculty and students involved
- Excellent public relations and recruiting for the university
What We Have Learned:
*It turned out quite different than we planned*

- Many, many partners
- K-12 science and mathematics education has changed much and often since 1991, so did we
- Emphasis on rural schools and underrepresented groups
- True engagement with schools and teachers, and all of the sciences.
Obstacles to Effective, Sustained Programs

- Focus on one science discipline
- “Grant and gone” syndrome
- Lack of flexibility and imagination
- Failure to integrate into the campus and the schools
- Underestimating the difficulty and importance of K-12 engagement
Things I Never Dreamed I Would Learn About ....

- Rural sociology and needs of rural areas
- Politics of state and local school systems
- Education professional associations
- Principals of adult education and distance education
- Partnerships with education foundations
- Education and economic development
- Under-represented groups and socio-economic groups
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- Our Many Partners

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http://www.science-house.org/conf