NNCI – Education and Outreach

NANCY HEALY

INSTITUTE FOR ELECTRONICS & NANOTECHNOLOGY

GEORGIA INSTITUTE OF TECHNOLOGY

SOUTHEASTERN NANOTECHNOLOGY INFRASTRUCTURE CORRIDOR

NNCI E&O as proposed

- Diverse set of programs proposed by 16 sites and 27 institutions
- The proposed coordinating site will be tasked to develop an integrated program that will reach all levels of the population
- Will differ from NNIN E&O
  - Networked program
  - Local and national programs
  - Accomplishments

NNIN – accomplishments in E&O

NNIN E&O

E&O program was located at GT's Institute for Electronics and Nanotechnology

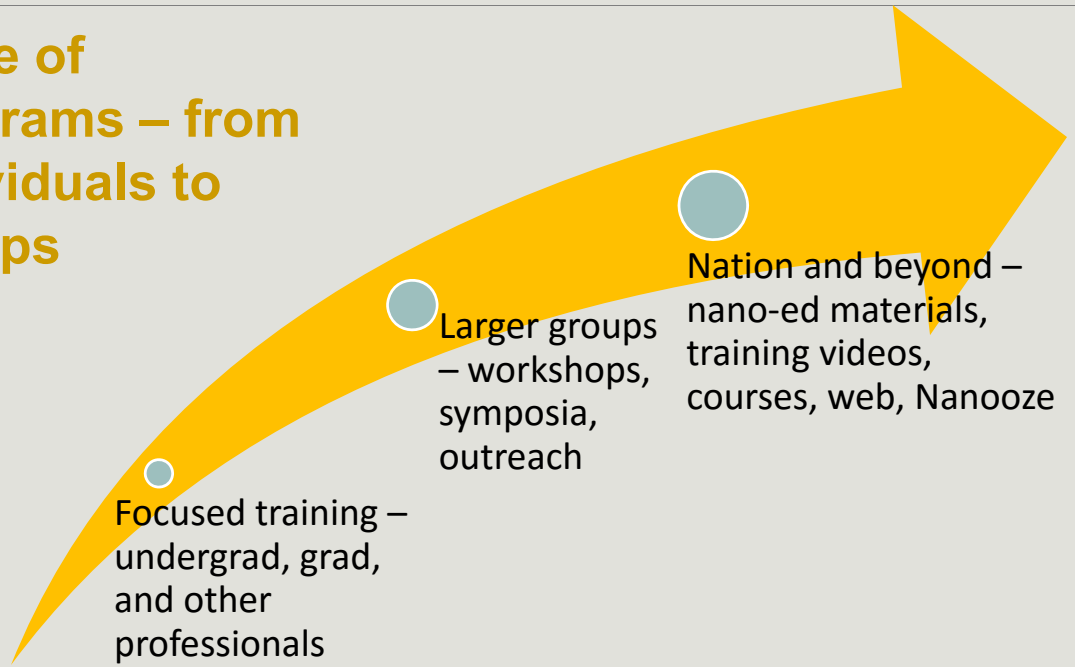
- Supported by 2 staff
- Most sites had a full or part time coordinator
- Directly reached >60,000 in 2014
  - 2004-2015: >350,000

NNIN Education & Outreach Mission

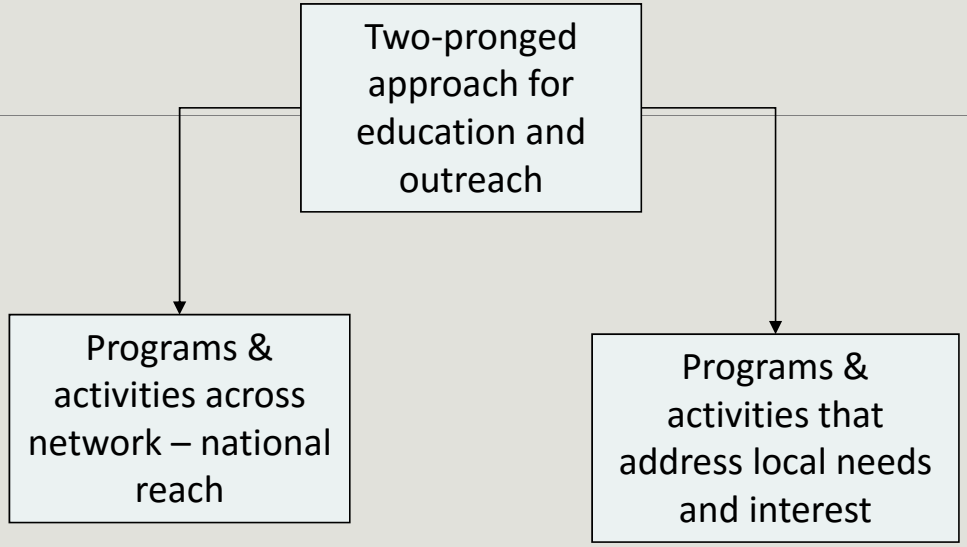
- Offer education and training to address the growing need for a skilled workforce and informed public
- Provide resources, programs, and materials to enhance knowledge of nanotechnology and its application to real-world issues
- Believe that a strong US economy requires a STEM-literate workforce ready to meet the technological challenges of a nano-enabled economy as well as an informed citizenry that supports continued and safe growth of nanotechnologies.

Scale of NNIN E&O programs - Educate a dynamic workforce

Scale of programs – from individuals to groups

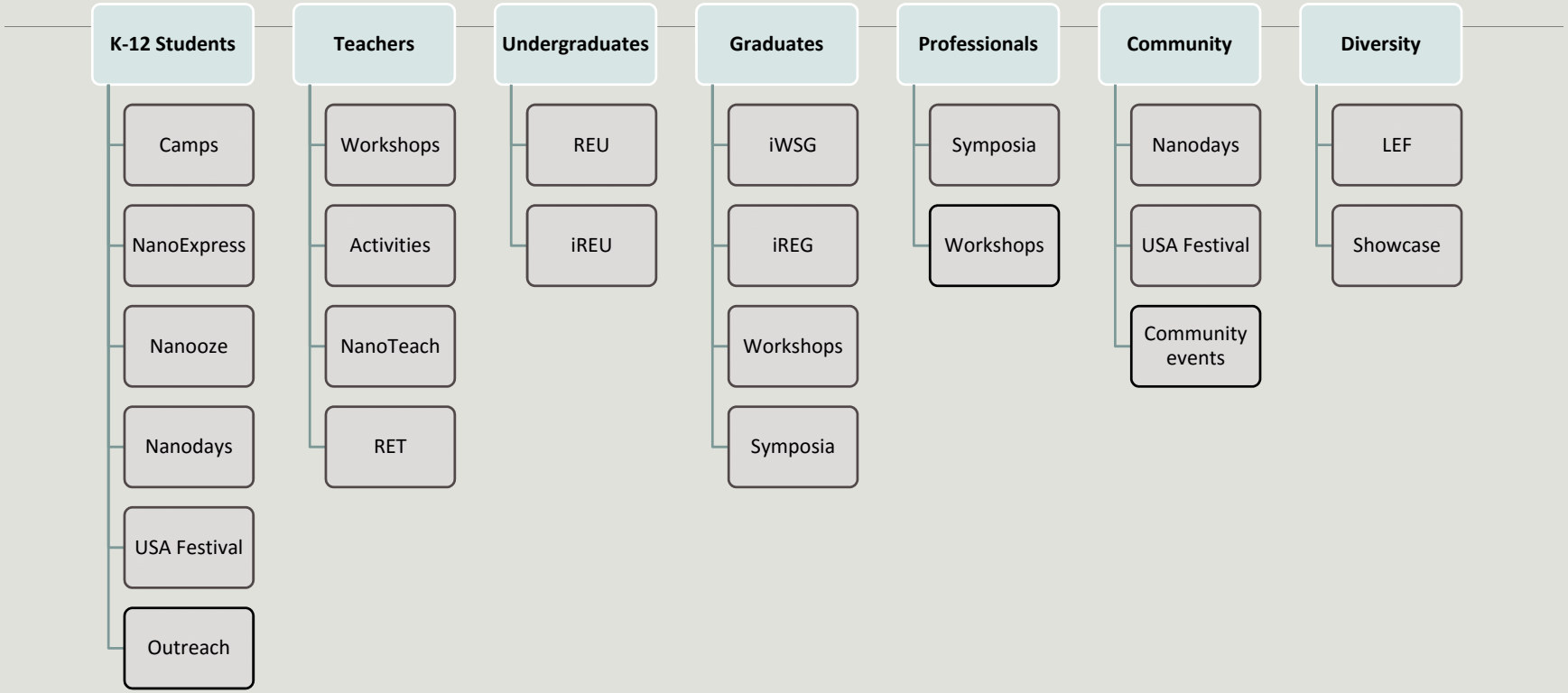


National and Local Activities



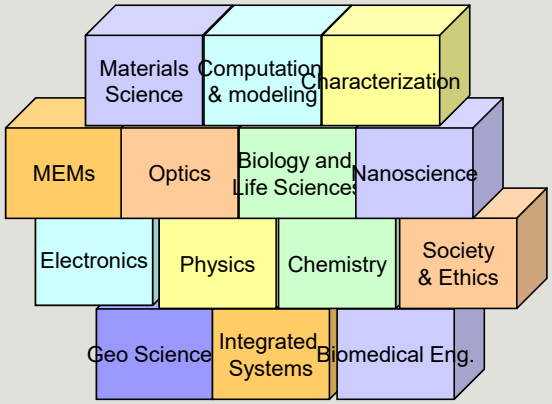
NNIN used the synergy from local and national programs to develop and maintain high quality education outreach that met the needs of diverse groups.

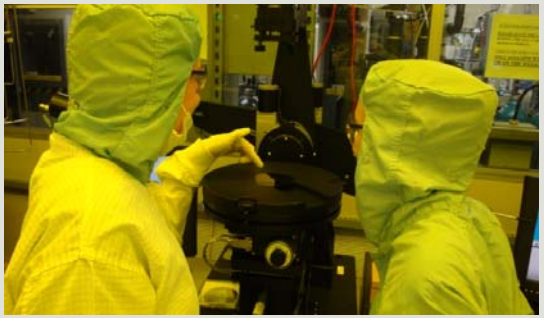
NNIN Education Programs by Audience



Research Experience for Undergraduates - Network Program

- Effective because of network cooperation
  - Network offered breadth of projects and visibility
- Best practices shared among sites
  - Network-wide **expectations**
- Ten weeks – research, convocation, *Research Accomplishments*

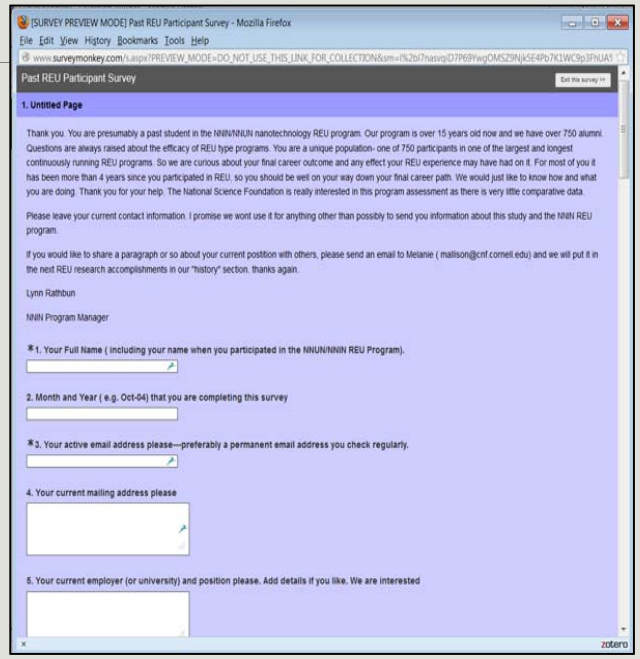




70-85 interns/year
Minimum 5/site

Longitudinal Tracking Study

- In 2007, began a formal program study of all NNIN/NNUN students who had been out of the program for 4 or more years.
  - 1997 - 2010
    - 2011 began this fall
- Response from 613 of 815 participants in the target years (~75%).
- Brief Survey Monkey "check-in" – link on NNIN home page
  - Solicited by email



[SURVEY PREVIEW MODE] Past REU Participant Survey - Mozilla Firefox

File Edit View History Bookmarks Tools Help

www.surveymonkey.com/s.aspx?PREVIEW_MODE=DO_NOT_USE_THIS_LINK_FOR_COLLECTION&sm=i%2bi7nasvqiD7P69YwgOMSZ9NjkSE4Pb7K1WC9p3FhUA3

Past REU Participant Survey

Exit this survey >>

1. Untitled Page

Thank you. You are presumably a past student in the NNIN/NNUN nanotechnology REU program. Our program is over 15 years old now and we have over 750 alumni. Questions are always raised about the efficacy of REU type programs. You are a unique population- one of 750 participants in one of the largest and longest continuously running REU programs. So we are curious about your final career outcome and any effect your REU experience may have had on it. For most of you it has been more than 4 years since you participated in REU, so you should be well on your way down your final career path. We would just like to know how and what you are doing. Thank you for your help. The National Science Foundation is really interested in this program assessment as there is very little comparative data.

Please leave your current contact information. I promise we wont use it for anything other than possibly to send you information about this study and the NNIN REU program.

If you would like to share a paragraph or so about your current postition with others, please send an email to Melanie (mallison@cnf.cornell.edu) and we will put it in the next REU research accomplishments in our "history" section. thanks again.

Lynn Rathbun

NNIN Program Manager

*1. Your Full Name (including your name when you participated in the NNUN/NNIN REU Program).

2. Month and Year (e.g. Oct-04) that you are completing this survey

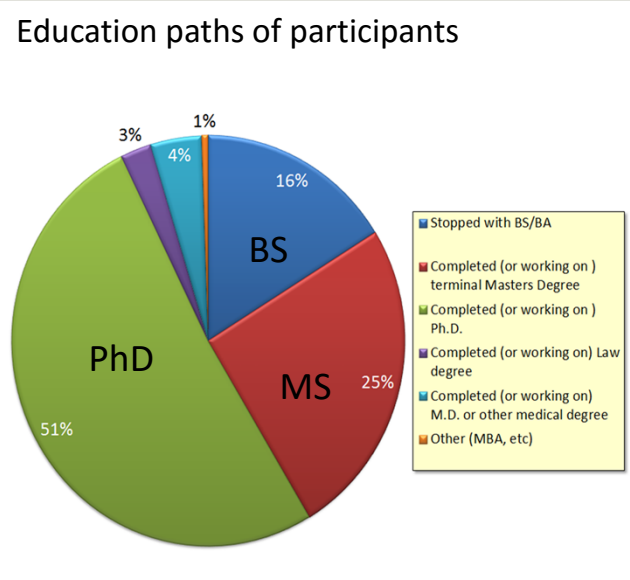
*3. Your active email address please---preferably a permanent email address you check regularly.

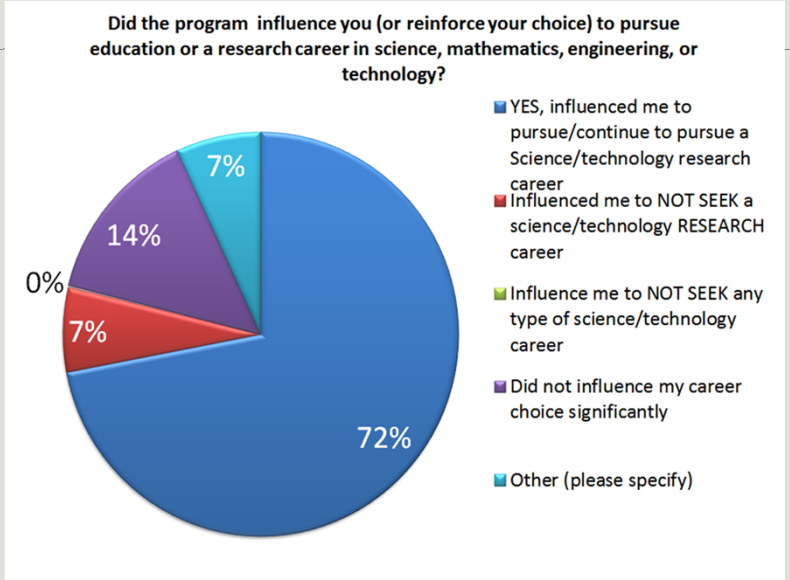
4. Your current mailing address please

5. Your current employer (or university) and position please. Add details if you like. We are interested

zotero

Longitudinal Study





Comparative data from Science and Engineering Indicators 2012 (2000-2009)	
Baccalaureate to Master's	~21-22%
Baccalaureate to Ph.D.	~7 – 8%

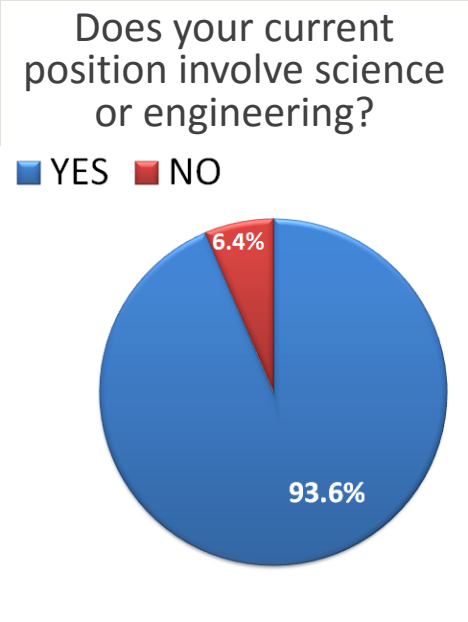
Longitudinal Study

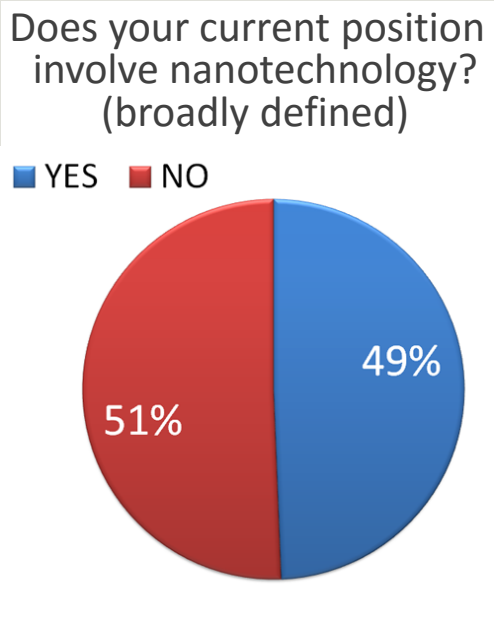
NNIN REU Longitudinal Study N=615	
Academic Path	1997-2010
Baccalaureate	16%
Master's	25%
Doctorate	52%
M.D./J.D./M.B.A	7%

NNIN REU Longitudinal Study Women	
Academic Path	1997-2010
Baccalaureate	18%
Master's	26%
Doctorate	48%
M.D./J.D./M.B.A	8%

NNIN REU Longitudinal Study Minorities	
Academic Path	1997-2010
Baccalaureate	19%
Master's	31%
Doctorate	42%
M.D./J.D./M.B.A	8%

Career Outcomes





N=613/815

International REU

International Partners

National Institute of Materials Science; Tsukuba, Japan (not 2011)

Forschungszentrum, Helmotz Research Center; Jülich, Germany

IMEC Leuven, Belgium

Technical University of Delft, The Netherlands

Ecole Nationale Supérieure des Mines de Saint Etienne; Gardanne, France

2nd year high quality experience in NSE research

Encourage & support promising students in STEM pipeline

Developing future STEM leaders with global awareness

NNIN iREU – Participant Outcomes

NNIN iREU

109 participants
2008 - 2015

Graduated Ph.D. 2

Non-academic *(currently)*

Employment
20

Currently in Graduate School

Undergraduates

Graduate School
68

Berkeley
Carnegie Mellon
Georgia Tech
Stanford
UCSB
UCSD
U. Colorado
U. Chicago
U. Minnesota
U. Michigan
Columbia

Case Western
Penn State
Cambridge
Mayo Graduate School
Iowa State U.
MIT
UCLA
Ohio State
Duke
Northwestern
U. Washington

NSF Fellowships
29 awarded and 9 honorable mentions (to date)

Still
Undergraduates

19

NNIN Research Experience for Teachers

NSF Awards
2006
2009
2012

2006-2012 – 5 NNIN sites

2012-2015 – 4 NNIN sites

~15-20 participants/year

NSE research projects

Classroom modules to Ed Portal

(90% RET)

8 week program

2006-2012 - NSTA event

2012- 2015 - NNIN Workshop

2006-2011: 169 total – 49% males; 51% females; 37% underrepresented; 67% taught in schools with high proportion of underrepresented students

NSF # EEC-0908895

Teacher Professional Development

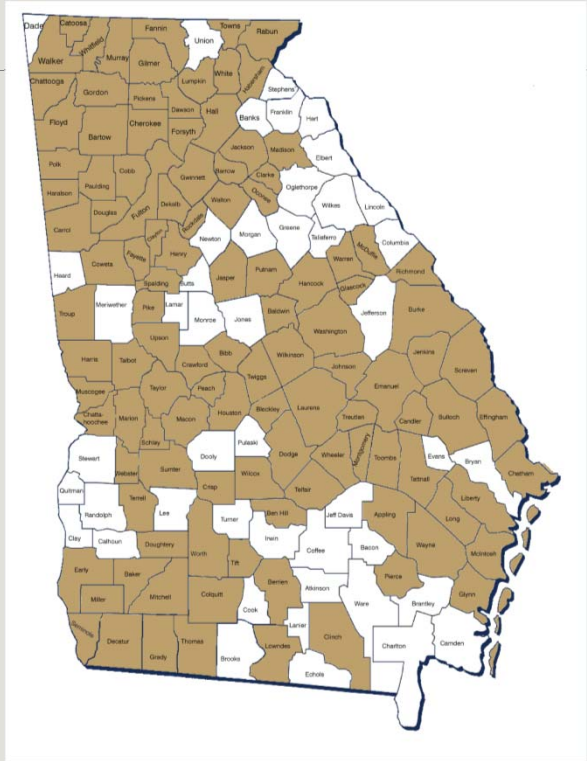
Local, regional, and national workshops

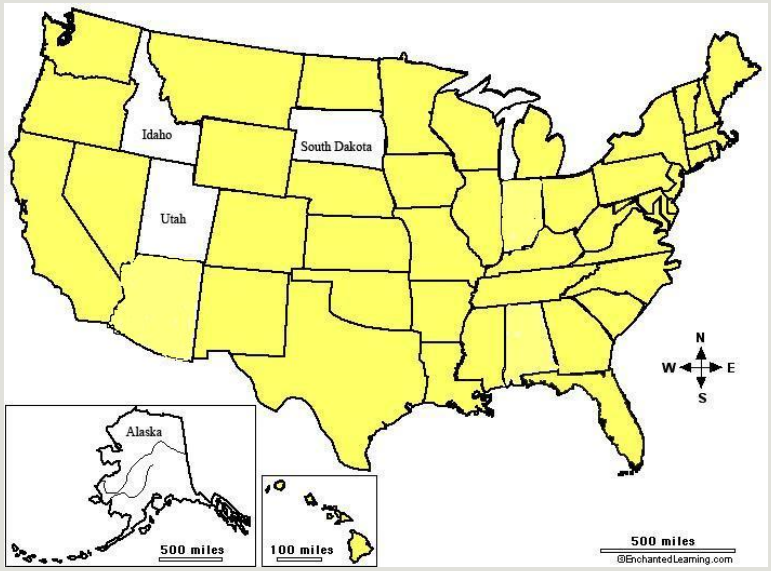
Duration: 2 hours to one week

Connecting NSE to K-12 science curriculum

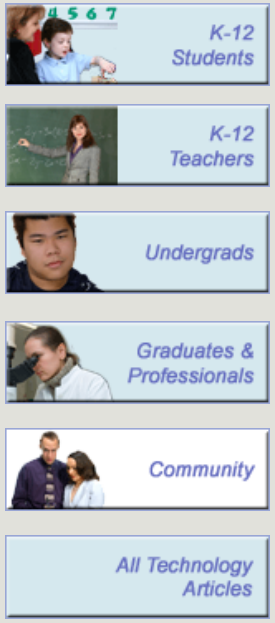
Addressing science standards using the big ideas of NSE

Teacher Workshops





NNIN Education Portal



General Information

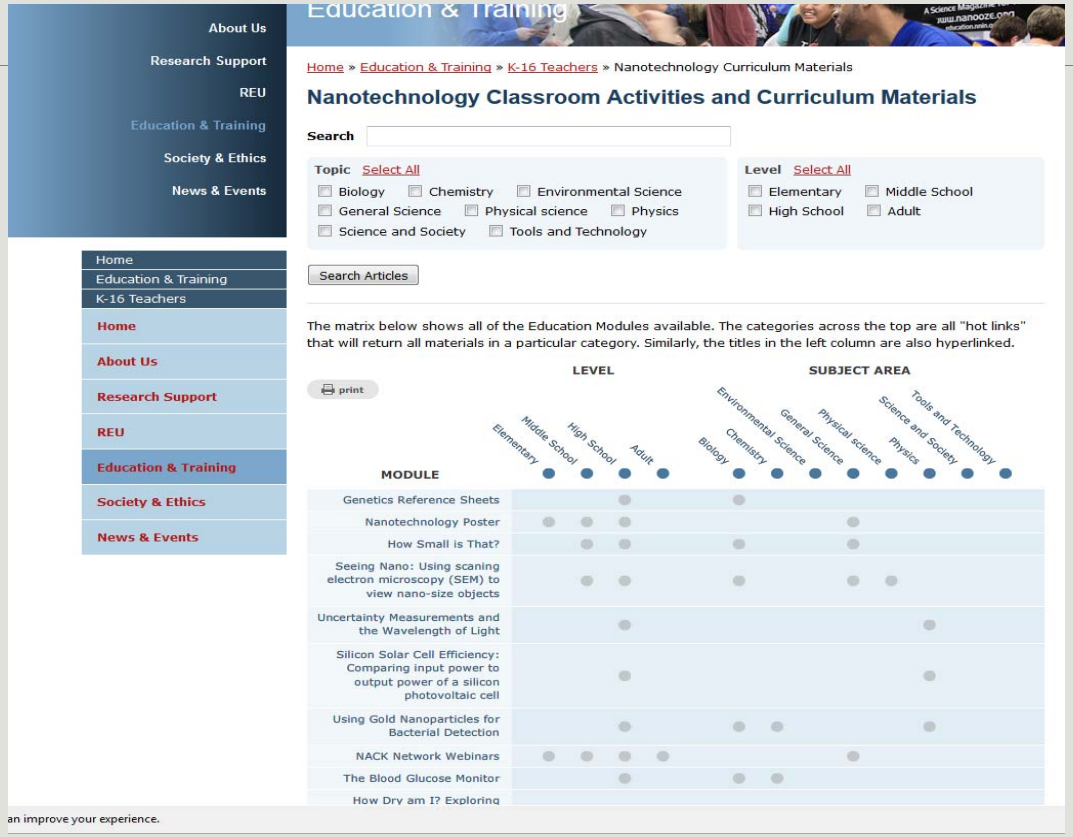
User Training Videos

Multimedia resources

K-12 Resources (teacher/student)

Nanooze

Curriculum Materials



90% written by RET participants

- *Nanooze*, the Web site
  - English, Spanish & Portugese
- *Nanooze*, in print
  - Since 2008
  - Free to teachers
  - 1MA in print
- *Nanooze* the exhibit
  - Disneyworld – Epcot
  - Disneyland - Tomorrowland

Prof. Carl Batt, Cornell

Workshops and Symposia

Education & Workforce

Undergrads, graduate students, post-docs, faculty, industry, government

Introduce NNIN capabilities to potential users

Help define new directions for network in developing areas of nanoscience

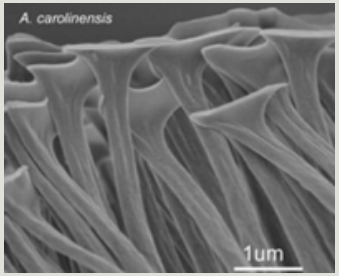
Multiple Duties/Multiple Audiences

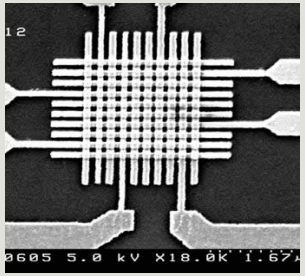
NNCI E&O from RFP

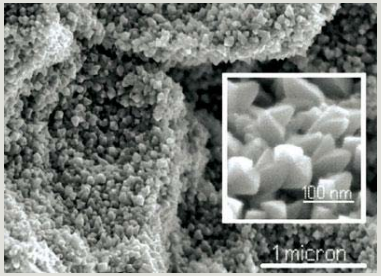
- Innovative educational experiences infused with content from the frontiers of nanoscale science and engineering research for graduate and undergraduate students, postdoctoral associates, and others
- Educational experiences may include REU and RET, domestic and/or international
- Development of instructional modules for incorporation into undergraduate curricula, and other novel educational resources and tools
- Educational outreach and workforce development plans
- Diversity and broadening participation: among students, faculty, staff, management, and outreach activities
- Outreach plans to increase the external user base: to encourage non-traditional users from diverse communities, and to reach potential users from startups and small businesses
- How the site may complement and connect to other local resources, such as business incubators, prototyping and manufacturing facilities
- Innovative strategies to disseminate effective practices and knowledge to the broader research, education, and technology communities

NNCI E&O

- 16 sites with 16 individual E&O programs proposed
- Common themes across the site programs which will lend themselves to collaboration and support
- New innovative programs that will target researchers, community colleges, MSIs and URMs, the general public and K-12 students







NNCI E&O

- 10 - 11 of the 16 sites will have a Research Experience for Undergraduates program
  - There will NOT be a network-wide program
    - Students should check individual NNCI sites for REU program information until the coordinating office is chosen.
- K-12 teachers
  - Three sites will have an RET program
    - Northwestern, UC San Diego, and Arizona State
    - University of Washington will have an educator in residence.
  - Three sites will offer teacher professional development
    - University of Nebraska, Montana State, and Georgia Tech

NNCI E&O

- Community & Technical Colleges
  - Seven sites will work with community colleges
    - U. Penn, Georgia Tech, Virginia Tech, NCSU, ASU, UCSD, Harvard
    - Two sites have community colleges as their partners
      - U. Penn and Arizona State
  - Focused on workforce development
    - Curriculum support
    - Cleanroom training
    - Internships
    - Summer Nanotechnology workshop – NCSU
    - Online training – Virginia Tech
    - Remote SEM access - ASU
    - Research Experience for Veterans - Harvard with Bunker Hill CC

NNCI E&O

Underrepresented scientists and engineers

- UT – directed outreach to HSIs
- Northwestern – outreach to Chicago schools and museums
  - URMs and women
- Virginia Tech – funding for MSI students to use facilities
  - African-American and Latino students from Howard and Georgia State
- Stanford
  - Two MSI Cal State colleges – coursework, hands-on training
- Cornell
  - User outreach to MSIs
- Nebraska
  - Conference on Women in Physical Science, Upward Bound, after school programs
- U. of Kentucky
  - Seed research programs for URMs
- ASU
  - Remote SEM to tribal schools
- Harvard
  - Scholars Program for URM grad students, post-docs, and young faculty

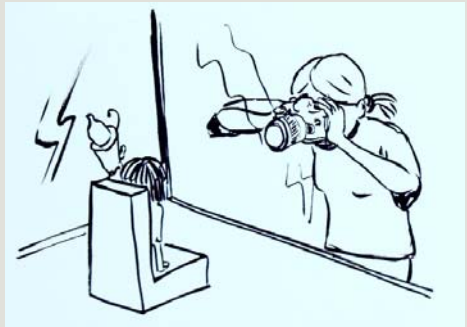
NNCI E&O

K-12 outreach

- Programs designed for middle and high school students
- Afterschool and summer programs
- K-12 schools use NCSU facilities for free
- Outreach to elementary schools
- *Nanooze* – website and magazine from Cornell
- Remote access of facilities
- Online training workshops

Public

- STEM events
- Museums
- *Pulse on the Planet* – radio broadcasts from VT
- NanoJournalism at Northwestern
- Community groups
- Science festivals



NNCI E&O

Undergraduate, graduate students, post-docs, other users

- Stanford
  - Document & disseminate process flows/protocols
  - Student program to develop and document new processes
- Technical workshops and courses – most sites
- Entrepreneurship
  - ASU support of student for certificate program
  - Entrepreneur in residence at UW
  - iCorps plus and professional development program for grad students and post-docs at Georgia Tech
- MOOC on nanotechnology – NCSU

NNCI E&O

Social and Ethical Issues of Nanotechnology

- Six sites will include
  - ASU, UT, GT, Montana State, Northwestern, NCSU
- ASU
  - SEI user facility for training researchers
  - Science Outside the Lab – two week policy experience in Washington, DC
  - SEI training of users
- UT
  - Research study examining SEI implications of nano with nanoscientists
    - In collaboration with UT College of Communication
- GT
  - I Corps plus – SEI module
  - SEI workshops and training

NNCI E&O

SEI

- Montana State
  - on-site and web-based instructional and outreach activities related to the ethics and societal impacts of nanotechnology
- Northwestern
  - Science in Society program
  - SEI outreach through NanoJournalism
    - In collaboration with the Medill School of Journalism
- NCSU
  - SEI research program
  - Assessment and evaluation of programs through SEI team

NNCI E&O

- NNCI E&O promises to impact all levels of society
- New and innovative programs have been proposed
- Some carryover of programs from NNIN
- Once coordination site selected more information on the programs will be available on the NNCI website

Thank You!

NSF ECCS-0335765
NSF ECCS-1542174