Global Nanoscale Science and Engineering Education

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This workshop brought together 140 nano researchers, educators and policy makers from 14 countries to share experience and best practices in NSEE via:

– Plenary and Keynote Lectures
– Panel Discussions
– Poster Sessions
– Group Breakout Sessions
– Group Reporting
About the GNSEE Workshop

• **Goal of this Workshop** - Develop a global NSEE community that will greatly enhance NSEE learning and teaching in formal and informal settings.

• **Vision** - use this community to work together to train the next generation of nanotechnology workers and global leaders to solve the challenges facing our world.
Types of Participants

- Educators
- Nanoscale Researchers
- Informal Education Experts
- Outreach Coordinators
- Funding Agencies

Graduate student Kristy Brumfield of LSU and Assistant Professor Emily Weiss of Northwestern

R.P.H. Chang and Nobel Laureate Harry Kroto

Researcher and educator Luis Fuentes of Mexico

Participants from Taiwan and South Korea

Karen Pollard of the NISE network for informal education

Mohammed Islam - nano researcher from the UAE
The success of the workshop was due to the following elements:

- Global Perspective from experts in 14 countries
- Integration of cutting-edge science with best practices in education
- Nobel Laureate, Harry Kroto – provided his insights and enthusiasm for Science Education
- Diversity of participants from researchers to educators to informal education experts
- Broadcast globally via webcast
Global Perspectives

CC-NanoChem Network of Excellence in Chemical Nanotechnology
Saarbrucken, Germany

Experimental Kit on Chemical Nanotechnology

5 experiments for secondary students

- Colloidal Gold
- Superhydrophobic coatings
- Superparamagnetic Suspension
- Superparamagnetic Nanocomposites
- Photocatalysis

Content courtesy of Dr. Martin Schubert of CC-NanoChem
Global Perspectives

University of Toulouse, France: COMBINING SCIENTIFIC KNOWLEDGE AND ETHICAL ISSUES

High school students design and take part in debates on “Socially Acute Questions” that relate controversial nanotechnology topics to ethical issues.

Socially Acute Question
(Simmoneaux, Legardez 2006)
Society
Mediatic Exposure
Reference Knowledge
School Knowledge (transposed)

Socially Acute Question?
Controversial
Controversial
Controversial

The highly engaged students then receive hands-on nano training during special summer schools such as the PANAMA: “PAttering at the NAnoscale – Methods and Applications”

First PANAMA School 2005
Second PANAMA School 2006
Third PANAMA School 2007
Global Perspectives

Mexico: CIMA V and Laboratorio Nacional de Nanotecnologia

Materials World Modules

- Hands-on, team-based experiments for middle and high school
- Professional development and research experience for teachers
- Developed at Northwestern University – launched in Chihuahua, Mexico in 2006

Content courtesy of Prof. Luis Fuentes of CIMA V
Global Perspectives

**EU Network of Excellence**
- 25 partners (28 labs)
- 15 countries

**Topical schools for graduate students**

**Public Information**
- Newspapers and TV

**Public Education Challenge**
- NANOQUEST 2007

Content courtesy of Prof. Sebastian Lourdudoss of KTH, Sweden
Taiwan’s National Nanotechnology Program

Through the establishment of common core facilities and education programs to achieve academic excellence in basic research, to create innovative industrial applications and to speed up the commercialization of nanotechnology.

Content courtesy of Prof. Fuh-Sheng Shieu of National Chung Hsing University
Global Perspectives

Taiwan’s Nano Education Scheme

Ministry of Education

Museums: NSTM, NMNS, NTSEC

E-KNOWLEDGE EXCHANGE PLATFORM

ADVANCED NANOTECHNOLOGY EDUCATION CENTERS

SPECIALTY TRAINING

INTERNATIONAL EXCHANGE

K-12 NANOTECHNOLOGY EDUCATION & DEVELOPMENT CENTERS

Content courtesy of Prof. Fuh-Sheng Shieu of National Chung Hsing University
Locations of Regional Centers (Advanced and K-12 Programs)

Nanoscale Knowledge Platform

Content courtesy of Prof. Fuh-Sheng Shieu of National Chung Hsing University, Taiwan
Teaching Materials for K-12 in Taiwan

Nanotechnology Symphony-Physics, Chemistry and Biology (Senior High)

“The Tiny but Beautiful Nano World ”
(the first brailed material specially designed for blind students)

Content courtesy of Prof. Fuh-Sheng Shieu of National Chung Hsing University

“Nanotechnology Teaching Material of Southern Center for K-12 Nanotechnology Center”
Teaching Materials for K-12 in Taiwan

Introductory Books
- The living universe of nano
- The Nano The Future

Cartoons and Teaching Kits
- “A Fantastic Journey for Nana and Nono”
- The Wonderland of Nanotechnology (Interactive multimedia teaching disc)

Supplementary Materials
- Game of Technology Midas – “Expert of Nano Technology”
- Magic Nano Phenomenon in Natural World
- “Nanotechnology Teaching in Sign Language Video”
- “Nano Hands-on Teaching Video”
Nano Carnival
June 2008
TAIWAN NANO exhibition
Key Workshop Recommendations

Engagement of Students:

- Relevance – connection to the world around them
- Use of inquiry and design based approach.
- Hands-on applications are critical to build self esteem
- Framework models and appropriate context.
- Digital media models, remote instrumentation, etc.
- Standardization of curriculum not practical
- Certificate and minor programs over degree options.
Engagement of Teachers:

- Continuous PD over time with follow up throughout year to build self confidence.
- Longer programs over short experiences.
- Team teaching, nano case studies.
- Interdisciplinary approaches.
- Engaging administrators to provide faculty PD nanoeducation opportunities.
Engagement of General Public:

- Use researchers and Nobel Prize winners as star power.
- Build on work from museums.
- Nano cafes and forums/seminars.
- TV programs and Hollywood.
- Use of clearing house to upload/download nano content
Workshop Outcomes

• Archives of presentations are available to public on www.nclt.us
• Engagement of Community – Strong interest and commitment among educators and researchers to form an integrated NSEE community
• Global Nanotechnology Network highlighted at workshop.
• Partner Networks in Africa, Asia, Europe, and the US
• **GNN development workshops** – 2001 (Mexico), 2003 (Japan), 2005 (Germany), 2009 (Rio de Janeiro)
• Diverse stakeholders in academia, industry, and government

*Education is a major project strand of the GNN!*
• A 4th GNN Development Workshop is planned during the IUMRS-ICAM 2009 conference in Rio de Janeiro

• Global partners are invited to help us:
  – Identify leading nanotechnology researchers, educators and policy makers from your countries and regions
  – Identify / obtain funding for them to attend the Workshop
  – Support student participation at the Workshop

• For more information, please contact mri@northwestern.edu