



How young can we go with Nano?

Developing a Partnership with the Madison Children's Museum



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IEG Vision & Philosophy



Encourage life long learners (K-grey) to Explore the Nanoworld!

Our philosophy:

Nanotechnology and materials science can be used to explore fundamental science and engineering concepts

Cutting edge research requires cutting edge educational approaches

Creation and dissemination approach

Education and outreach events are research opportunities



Past Partnership



Discovery World Museum (Milwaukee, WI)
Co-Principal Investigator on Internships in Public Science Education (IPSE) grant through National Science Foundation (NSF) (2001-08)

Grant Activities:

Developed curriculum for use in middle school classrooms

Held workshops for teachers on nanotechnology

Additional grant from The Ira and Ineva Reilly Baldwin

Wisconsin Idea Endowment:

Designed and built a stand alone exhibit on nanotechnology housed on UW Engineering campus



Nanoworld Discovery Center at UW



Past Partnership



Strengths of each partner:

University	Science Center
Formal, structured, linear learning, assessment	Informal, non-linear learning, “wow” factor
Deep knowledge of science content	Broad knowledge of science content
Knowledge of current research advances	Knowledge of communicating science to the public
Development of experiment and demonstration content	Development of presentation and exhibit packaging
Access to research and library facilities	Access to science center facilities
Connections to other academic institutions	Connections to business leaders, community leaders, K-12 school system
Experience with public granting agencies (e.g. NSF)	Experience with marketing and graphic design
Access to interns, faculty experts	Access to K-12 teachers, youth and community groups



Past Partnership



Challenges:

Geographic distance

Discovery World in the midst of rebuilding/moving

Limited staff time

Sensitivity to student interns

Different communication styles

Mismatched timelines for completion of products



Current Partnership



Nanometer Informal Science Education Network
(NISE Net)



IPSE renewal focused on exhibit development

Current sub-awardee of NISE Net

Activities include:

Exhibit development

Program development

Regional training workshops



An afterschool science club makes nano-stained glass during a NISE workshop held at OMSI (March 2008)



Visitor to UW's Engineering Expo 2007 tests out the "Mitten Challenge"



Current Partnership



Benefits:

Synergistic activities with IPSE

Better understanding of effective exhibit and program development

Enhanced programs through iterative design and evaluation

Improved and expanded evaluation methods

Increased awareness of universal design needs

Excellent professional development opportunities for interns

Challenges:

Museum partners are not geographically close (lots of travel)

IEG/IPSE/NISE Net goals do not directly overlap



Lessons Learned



From these two partnerships, we learned:

1. A program/exhibit **has** to be fun
2. Front end assessment is extremely valuable
3. There is a wide range of evaluation tools and methods
4. Interns learned the long process of program development through iteration
5. Partnerships are a lot like dating



How young is too young?



UW MRSEC's current nanotechnology programs and materials are best suited for middle school and above.

Challenges of nanotechnology

Complex concepts

Scale very difficult to understand

Young audiences struggle with the "invisible"

Atoms not part of K-4 students'

vocabulary/understanding

Very little data available

especially with respect to young learners



Girls from Eau Claire (WI) H.S. experiment with a "scanning probe microscope"



A young boy enjoys a nanotube balloon model



Exploring a New Partnership



Partner with museum focused on young audiences to create innovative age and developmental stage-appropriate materials

Informally explore a partnership while institutions get to know each other

First steps:

Distill core concepts related to nano

Modify existing and create **new** materials

Test materials with target audience

Future (?) steps:

Joint proposal to formalize partnership





Preliminary Program Development



Introduce nanotechnology through **Applications**

Nanotube scavenger hunt

Learning goals:

1. Nano is small, too small to see
2. Nano is in our everyday life

Brief introduction to “technology too small to see”

14 images of nano-enhanced products hidden around the museum

Kids predicted which special property of nanotubes was used to improve each product (strength vs. electrical conductivity)

Outcomes:

Surveys indicated a shift in scale when asked what the smallest thing they could think of



Girl at Madison Children's Museum's Brownie Night (November 2007)



Preliminary Program Development



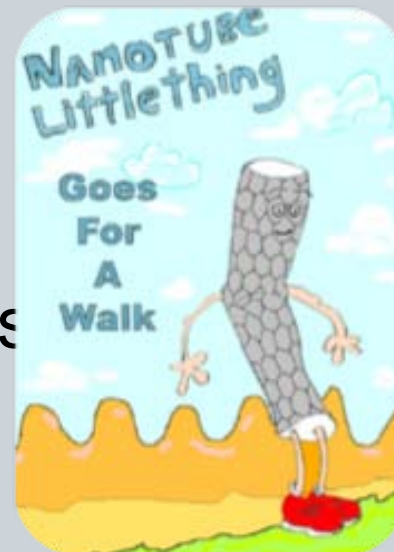
Introduce nanotechnology through **Hands-on Art Activities**

Nanotube Littlething (NTLT)

Cartoon character created by IPSE intern anthropomorphizes nanotubes. Draft story line explores how small Nanotube Littlething is—and his big potential!

Nanotube Littlething Coloring contest for NanoDays 2008

Children made Nanotube Littlething puppets



Two girls help each other attach legs and googly eyes to Nanotube Littlething (April 2008)



Acknowledgments



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Materials Research Science and Engineering Center on Nanostructured Interfaces



The Ira and Ineva Reilly Baldwin
Wisconsin Idea Endowment



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Preliminary Program Development



Introduce nanotechnology through **Hands-on Art Activities**

Nanostained glass sun catchers

Learning goal:

When things are VERY small, they can behave differently

Modification of pre-existing nanostained glass program

Idea came out of NISE Program workshop

Activity modification limits chemical use and addresses variation in young learners' manual dexterity





Preliminary Program Development



Introduce nanotechnology through

Balloons

Nanotube balloons

Learning goals:

1. Nano is small, too small to see
2. Scientists build models to “see” and understand things that are invisible

Kids built a one-story tall nanotube using balloons

Leader facilitated a discussion of models, and their strengths and weaknesses

Outcomes:

Participants frequently said the balloon activity was FUN!



Girls at Madison Children's Museum's Brownie Night build a nanotube (November 2007)



IEG Technique & Materials



Technique:

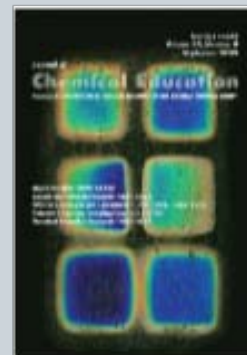
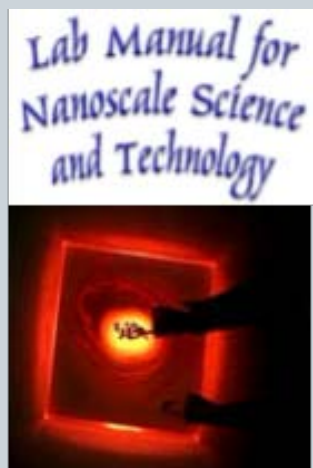
Strong partnerships with a diverse range of key institutions and individuals

Cross campus interdisciplinarity

Efforts anchored in post-docs and collaborators

Evaluation, assessment and IRB approval

Products and materials:



¡En Español, tambien!

www.mrsec.wisc.edu/nano