

Delivering **Nano-STEM** education to your mobile device

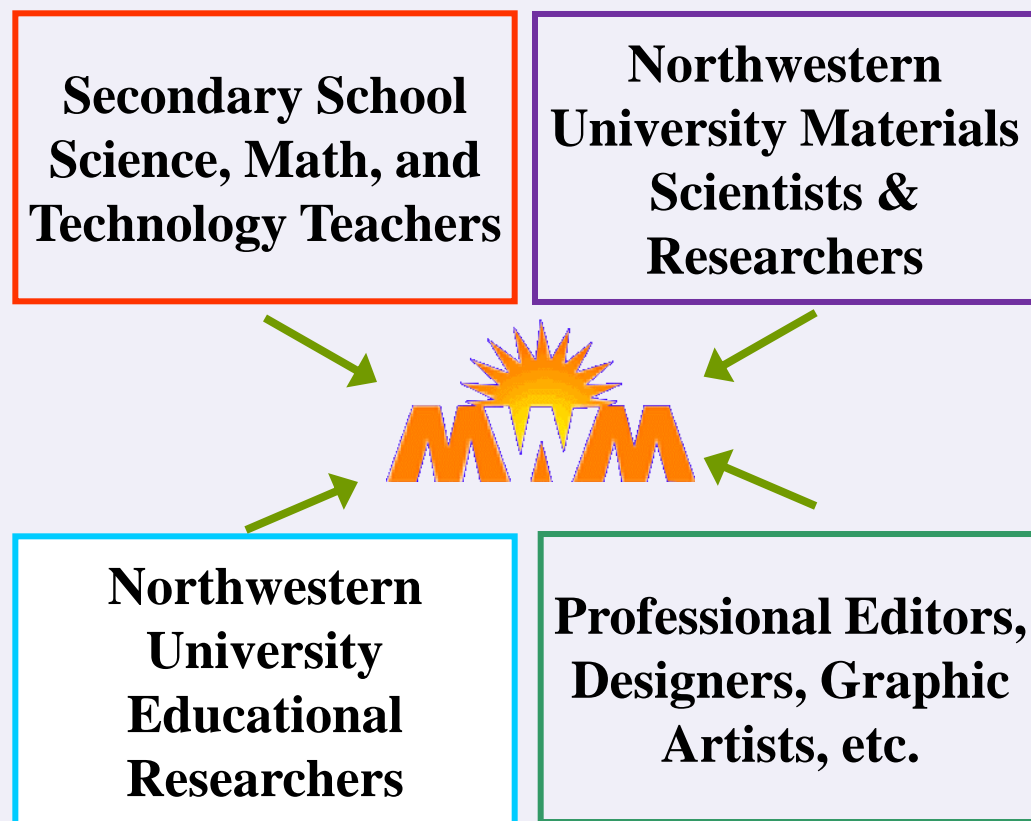
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Why use multimedia interactive digital technology ?

- **Mobile Access** → equal access
 - 60% of the teenagers have smart phones, especially low income households are much more likely to go on-line with smart phones.
- **Multimedia learning dynamics:**
 - Reinforces understanding and improves retention; 3-D, time dependent phenomena
- **Interactivity and Self-Driven Learning:**
 - Allows students to experience instant responses to their actions
- **Personalized learning and teaching**
 - Teacher monitoring; ease assessment function
- **Integration of cyber-learning with real-space activities,** such as modeling and design

Content: Materials World Modules (MWM)

- With NSF support starting in 1993, a collaborative effort to develop MWM as a supplemental STEM curriculum was launched by using principles of inquiry & design.
- In 2004, the NCLT added nano concept modules to the list.
- NCLT also helped to launch web-based animations, simulations and games to enhance STEM learning



MWM Method:

Inquiry (Science): Students ask questions and perform experiments - **Discovery and critical thinking!**

Design (Engineering): Students apply what they learn to make functional products - **Creativity and innovation!**



Process:

The Hook (piques interest)



Staging Activities (Inquiry)



Design Challenge (team-based)



Testing and Redesign

The MWM Program Includes:

TE/PE Booklets



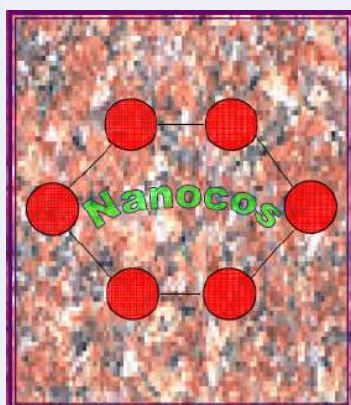
Classroom Kits



Teacher Professional Development



Online Animations, Simulations and Games



Carbon Atom

This card requires a microscope that can view objects 10^{15} m in length.

Surface Area $1 \times 10^{23} \text{ m}^2$	Surface Area to Volume Ratio $10^{12} \text{ m}^2/\text{m}^3$
Volume $1 \times 10^{35} \text{ m}^3$	



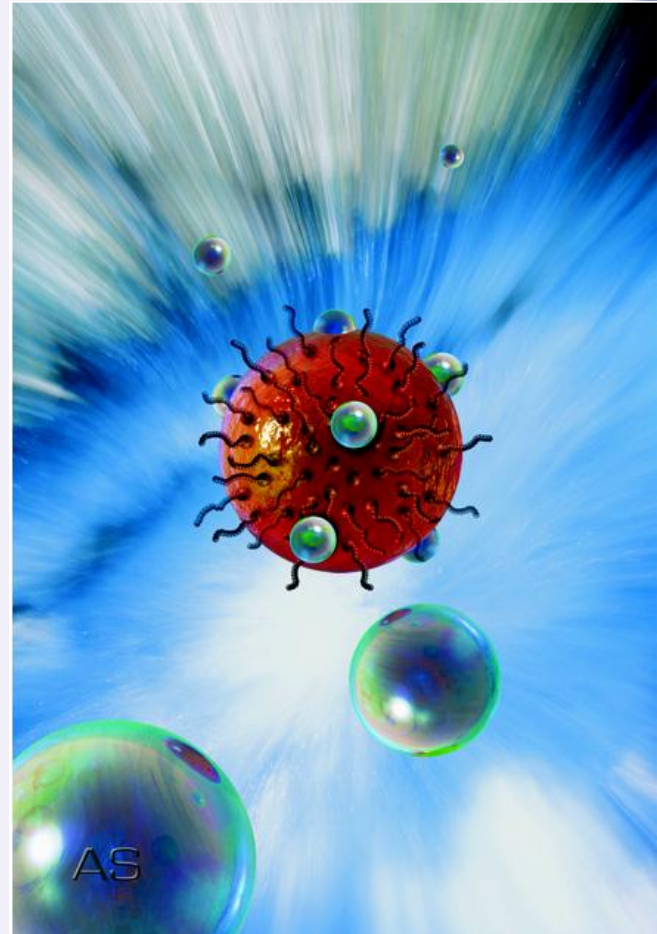
A game interface showing a scale meter and various objects. The scale meter ranges from PICO to GIGA. Objects include Superman, Eiffel Tower, and a small white robot.

Modules Applying Nanotech to Global Challenges

Modules Pertaining to Environment, Food, Water

- Polymers
- Environmental Catalysis
- Concrete
- Food Packaging Materials
- biodegradable

New carbon sponge for recycling



Nano magnetic particles to extract toxic arsenic

Current MWM Technology Tools

Online simulations, games, lessons, workshops

NCLT National Center for Learning and Teaching in Nanoscale Science and Engineering

Gold Nanoparticles: How do light and gold nanoparticles interact?

Why do Gold Colloids have Colors?

Click on the flashlight to see how gold nanoparticles interact with light.

White light is split into its color components by the prism.

Conduction electrons of metal nanoparticles have resonant frequencies. When they interact with electromagnetic waves having the same frequencies, the wave energy is absorbed by the particle.

For example, gold nanoparticles having diameters of about 10 nm strongly absorb light energy with wavelength of 500 - 600 nm and somewhat absorb shorter wavelengths.

PRISM LIGHT BULB SLIT

BACK QUIZ

USTREAM

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Live broadcast started 2 hours ago embed codes / prep out / flag

With the Social Stream you can chat with your friends over the

Chat Social Stream

mr-northwestern

- 4:15 met_www: messaging test
- 4:15 met_www: instant message testing
- 4:17 met_www: test 2
- 4:17 met_www: test 3
- 4:17 met_www: test 4
- 4:17 met_www: message from audience
- 4:17 met_www: what is nano?
- 4:17 met_www: how to play a power point while the show is

Media Stream 2 Viewers / Broadcasting Live

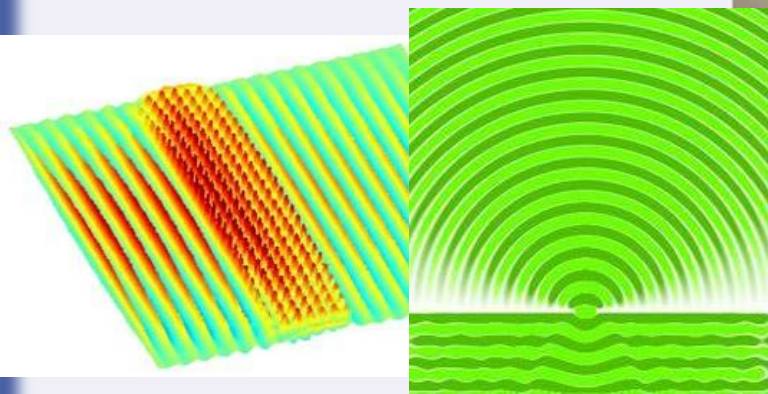
View All

SCORE 300

SAMMY THE SUPERSCALER

SCALE METER

- GIGA
- MEGA
- KILO
- HUMAN
- MILLI
- MICRO
- ANO
- PICO



Nanocos

Carbon Atom

Carbon Nanotube

requires a microscope that can 10^{10} m in length.

Surface Area to Volume Ratio $10^{12} \text{ m}^2/\text{m}^3$

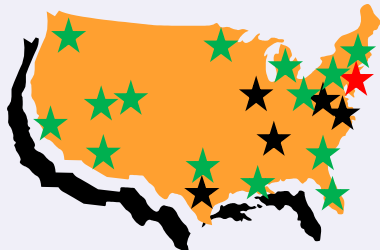
green card from your hand, then shuffle

3-Phase Expansion Plan of i-MWM in cyber and real space

Scaling up i-MWM



Phases of Expansion



★ ★ ★ Phases I, II, III

Integrated implementation of activities in real & cyberspace



Multi-media platform enhances understanding: 3D visualization, time-dependent phenomena, mathematical manipulations



Cyberspace Activities in i-MWM:

Assignments
 Exploration via animations, simulations, & games
 Logging hypotheses & results in "Classroom Portal"

- Pre & Post module testing

Real Space Activities in class:

Discussion about material & simulated outcomes
 Lab Activities
 Design Projects



External Evaluation



Pre & Post-test data



Cyber Community for STEM Edu. & Workforce Development

- Students, Teachers, Parents, Universities, & Industry Stakeholders

Dissemination of Information

- Journal articles, Community resources, Policy documents

Demonstration