

Introducing the Materials World Modules in Chihuahua, Mexico

OUTLINE

- Materials Science as a Tendency in Science
- CIMAV: Research and Education
 - The MWM Project
 - The MWM Mexican Project

R. Chang, NWU

M. G. Chacón, SEC Chih.

S. Maloof, SEC Chih.

J. González, CIMAV

L. Fuentes, CIMAV

An NSF Inquiry-based Science and
Technology Education Program



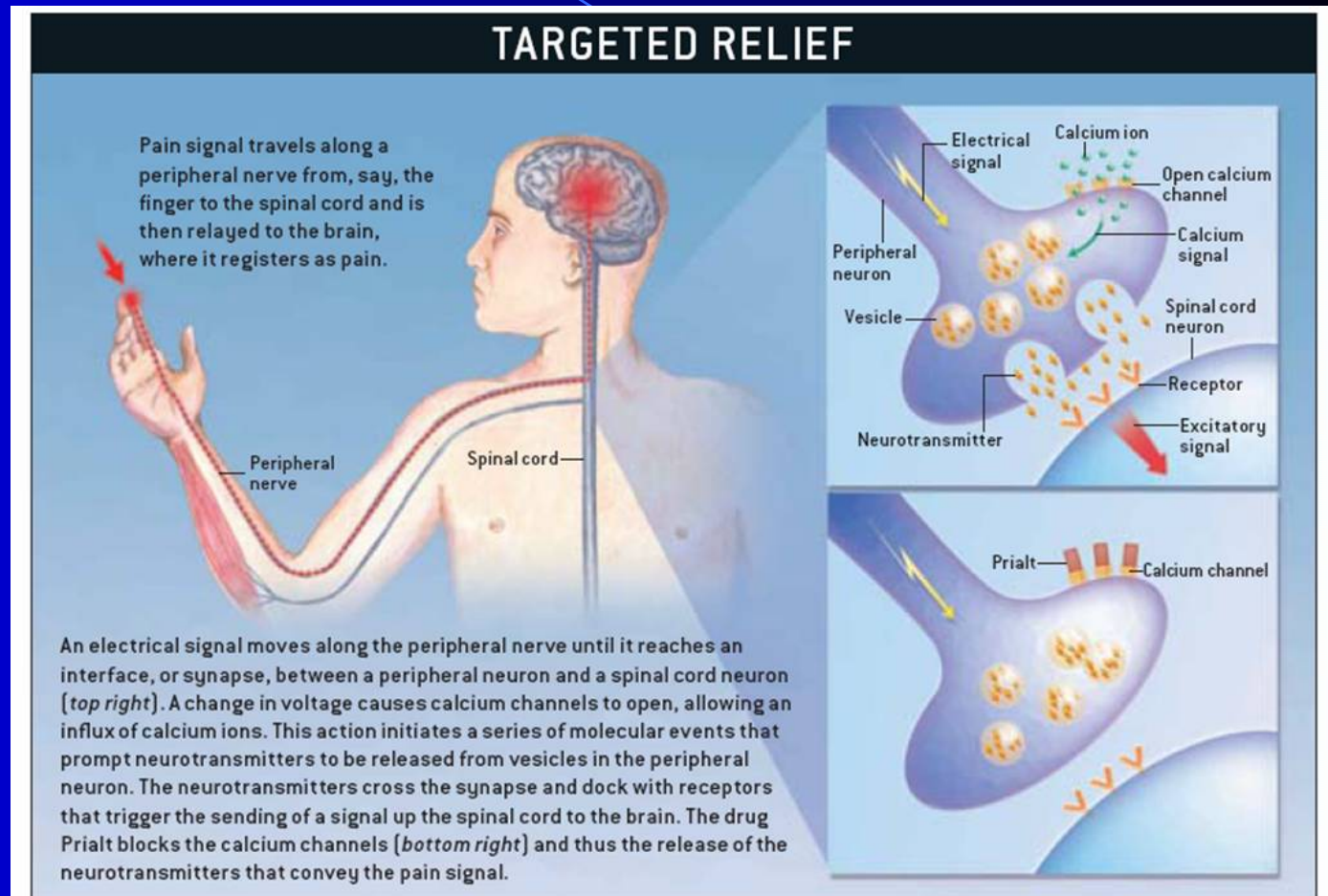
Integration in Science

Discovery of the
new analgesic
“ Ω -conopeptide”.

Physics?

Chemistry?

Physiology?

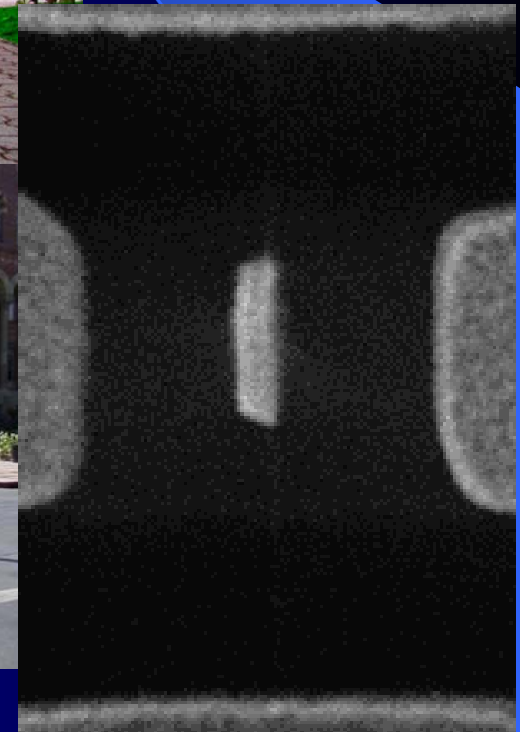
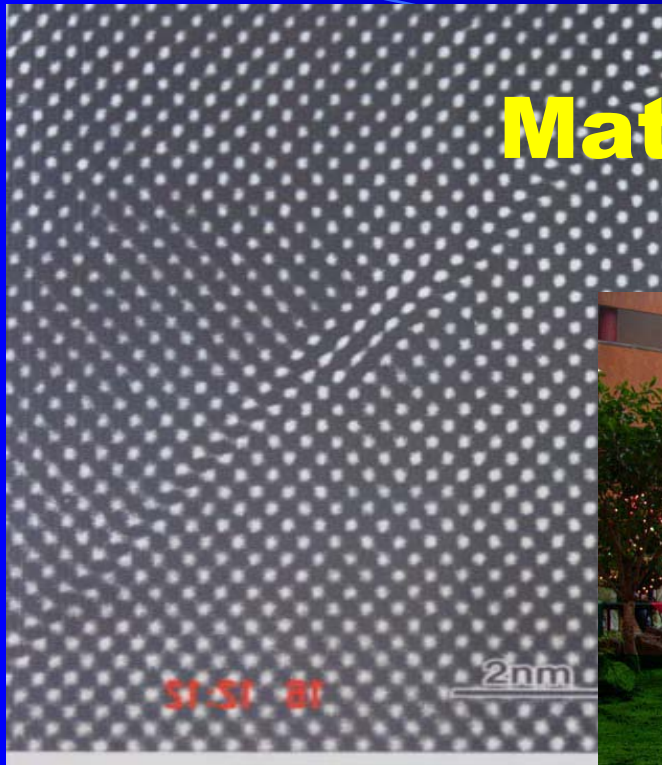


Stix, Scientific American, April 2005

Materials Science

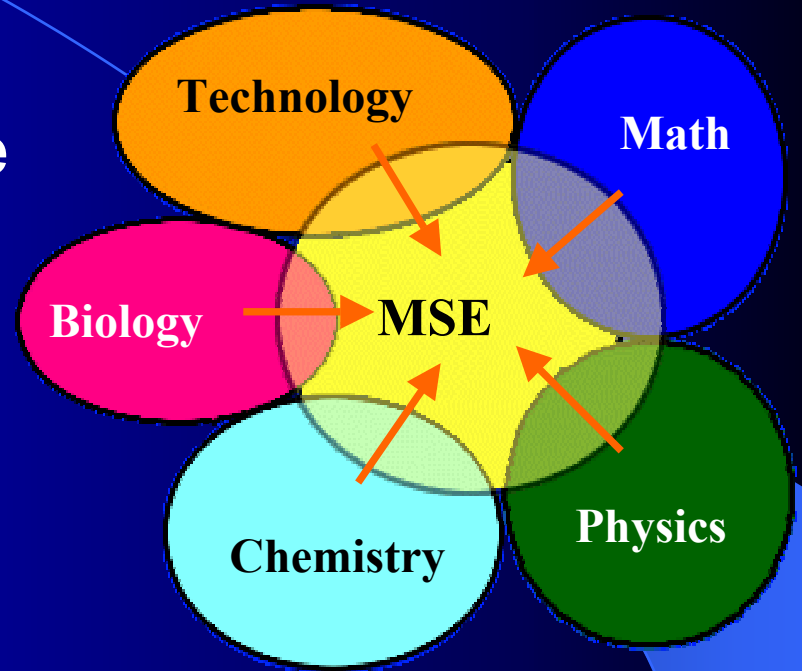


- Research
- Education



Materials Education?

- ❑ **Interdisciplinary** – UNESCO is calling for the “breakdown of traditional disciplinary barriers” to *improve science literacy*.
- ❑ **The Right Mix** – UNESCO calls the “cross-disciplinarity” between Chemistry, Math, and Physics a “*global science education priority*.”



MSE provides an interdisciplinary approach to science and math education.

Key Challenge

Work together to develop instructional materials and methods that *stimulate students natural curiosity* and *get them excited* about science and technology.



A Team-based Approach

**Secondary
School Science,
Math, and
Technology
Teachers**

**University
Scientists &
Researchers**



**University
Educational
Researchers**

**Professional
Editors, Designers,
Graphic Artists, etc.**

MWM's Model: Inquiry and Design

- Students complete a series of hands-on, *inquiry-based* activities
- Each module culminates in *design challenges*
- Students simulate the work of *scientists (through inquiry)* and *engineers (through design)*

Inquiry cycle

Identify a question.
Propose an explanation.
Create and perform an experiment to test the hypothesis. Based on results, refine the explanation.

Goal: an explanation

Design cycle

Identify a problem.
Propose, build, and test a solution to the problem. Redesign, Based on results, to improve the solution.

Goal: a functional product



Real-World Design Projects

- **Biodegradable Materials** **Medicine-delivery device**
- **Biosensors** **Cholesterol, Glucose biosensor**
- **Ceramics** **Voltage-protecting device**
- **Composites** **Strong, lightweight fishing pole**
- **Concrete** **Roofing tile, concrete Frisbee**
- **Food Packaging** **Environmentally friendly chip pkg.**
- **Polymers** **Humidity sensor, new polymer product**
- **Smart Sensors** **Coin counter, smart device**
- **Sports Materials** **Hi-bounce superball, mini golf course**

Inventing a New Shoe

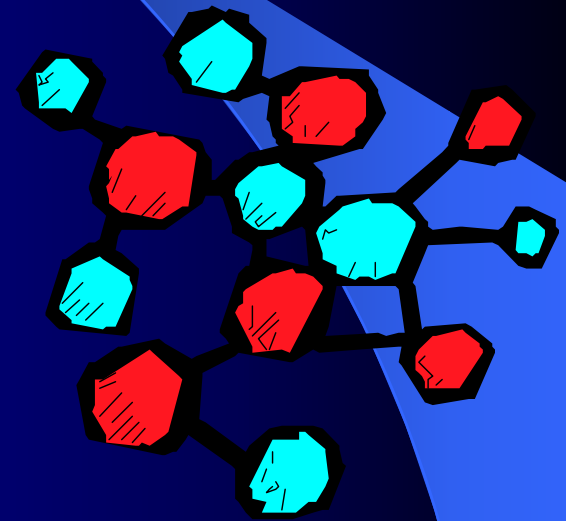


Making a Better Basketball Net



MWM Activity Kits

- Starter and refill kits are available for each module
- Kits contain enough materials to do the module once with a class of approximately 24 students
- Kits range in price depending upon the materials they contain



Teacher Professional Development



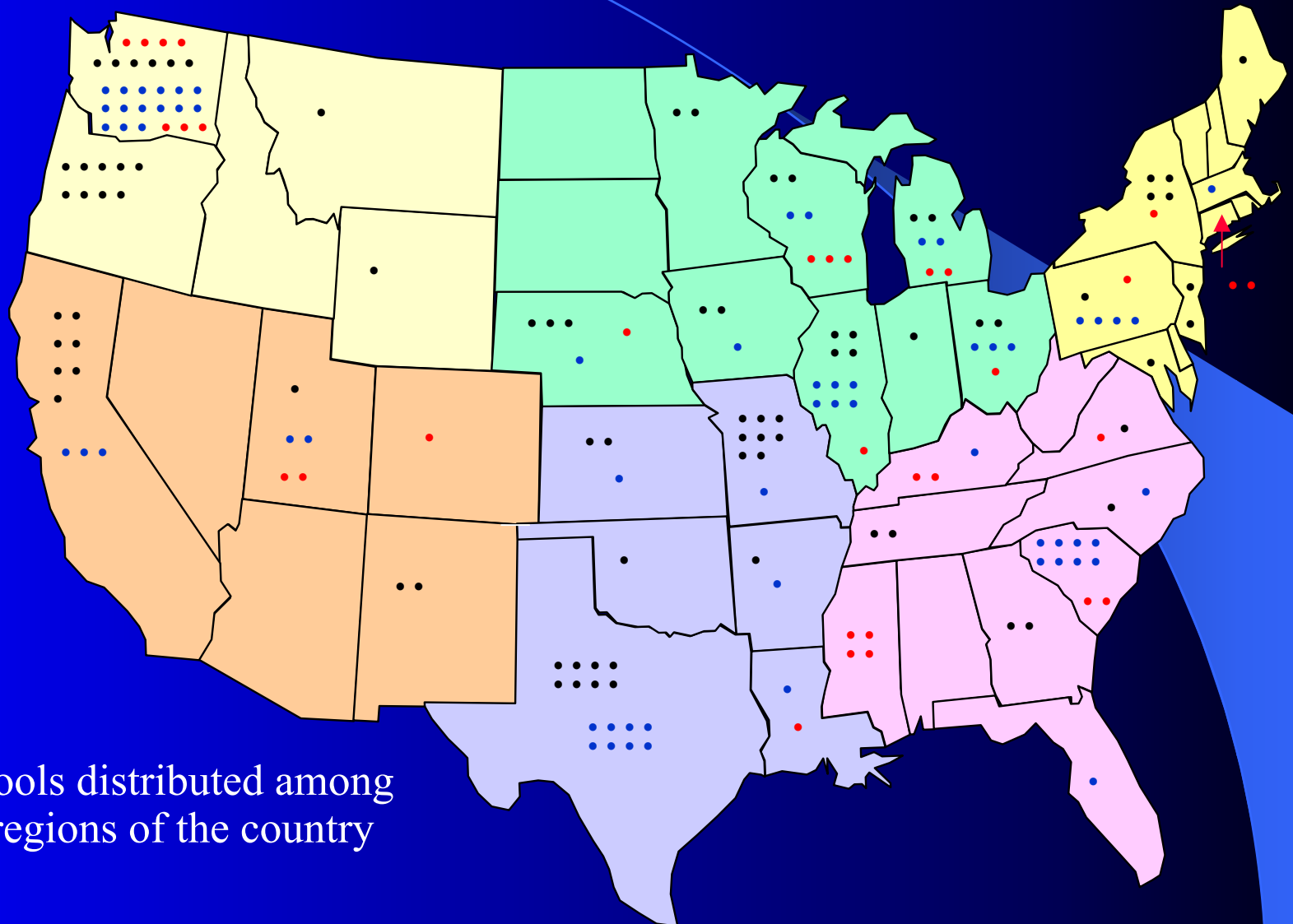
Pre-service Teachers
at Universities



Teacher Workshops



Field Test Participants

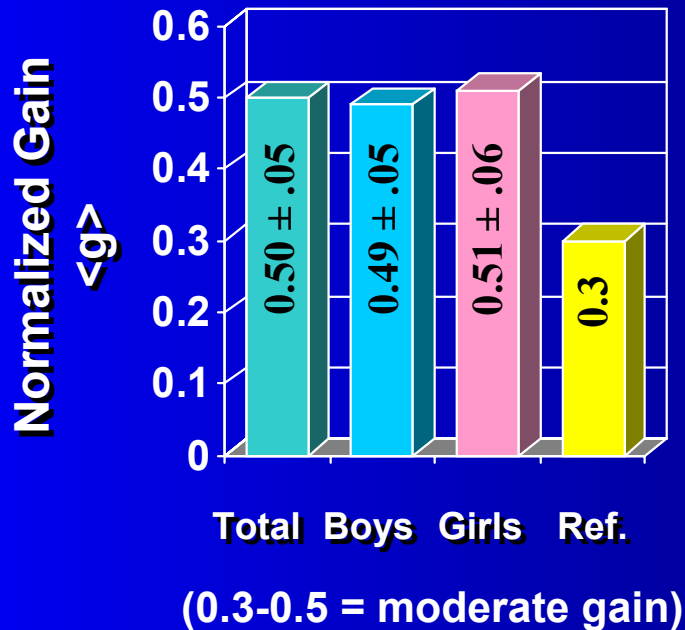


➤ Schools distributed among six regions of the country

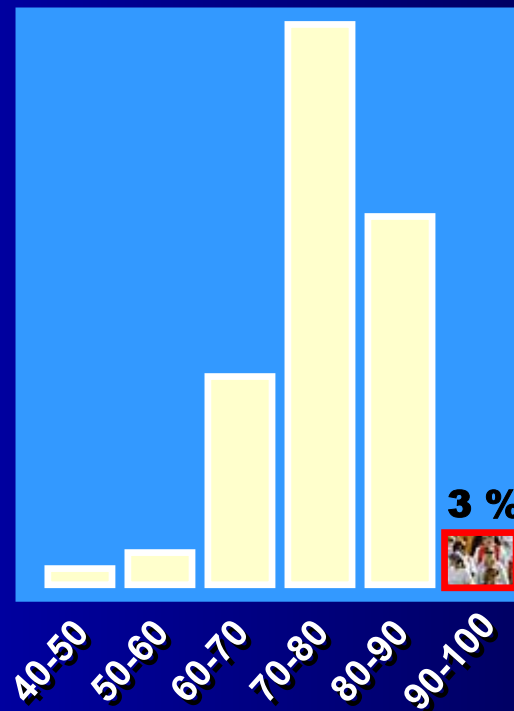
STUDENT ACHIEVEMENT

Normalized Gain Data

(How much a class gained from pre to post test)



Traditional Classroom



MWM



Chihuahua MWM Pilot Plan

Create an MSE course for high school students, based on MWM modules.

- ❖ Translate content into Spanish
- ❖ Adapt content to meet local needs
- ❖ Prepare teachers (inquiry and design)
- ❖ Field test the course in classrooms
- ❖ Improve course design as needed
 - **SEC - CIMAV joint project agreed**
 - **“Composites” module already translated**
 - **Prof. Chang’s Workshop for 50 high-school teachers’ training starts 5/5/05**