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Teaching the Notion of Nanotechnology

Science of Manipulating Super-Small Objects Inches Its Way Into Classrooms

By Valerie Strauss
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Scientist Robert P.H. Chang of Northwestern University had no trouble persuading education officials in Mexico to introduce the burgeoning field of nanotechnology to schools there, but it's been a far tougher sell in the United States.

In Mexico, Chang said he had only to speak about the subject to top government officials, who then simply ordered school officials to teach it.

For better or worse, things work differently here at home.

Multiple factors make it tough for new fields such as nanotechnology -- manipulating matter at the smallest of scales to create new materials -- to get introduced in classrooms in a broad way, educators say. They include:

- 15,000 school systems in the country, each with its own curriculum.
- Differing state standards that spell out what kids should know.
- Different high-stakes standardized tests that assess whether students meet the standards.

Recognizing that changing curricula can be next to impossible, the Nanoscale Informal Science Education Network is developing and distributing programs aimed at engaging schools in nanoscale science and engineering education, said Carol Lynn Alpert, director of strategic projects at the Museum of Science, Boston, and a co-principal investigator of the network.

It is vital, she said, for Americans to have some understanding of today's scientific revolutions and the risks and benefits they offer.

"We are living in a democracy, imperfect as it is, in which the notion is that we jointly make decisions about the investment of our research dollars," Alpert said. "It's important that people have a sense of what is the new science."

Nanotechnology presents an especially difficult challenge in education. It is not a traditional discipline but rather a combination involving physics, chemistry, biology, mathematics, engineering and technology.

It holds the promise of creating more effective medicines, cleaner fuel and other products to improve quality of life, according to Andrew Maynard, science adviser to the Washington-based Woodrow Wilson Center's Project on Emerging Nanotechnologies. And it is likely to force changes in the way universities organize their departments and how students are taught.

But first they need to know what it is.

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Leah Gonzalez, 14, certainly didn't know what it was when she, along with other kids on Team Tikki of McLean, first learned that it would be the theme for a 2006 competition sponsored by the First Lego League, an international children's program that promotes interest in science with a hands-on interactive robotics program in a sportslike atmosphere.

She'd never heard about it in school, she said, and for that matter, her mother, the team's sponsor, didn't know what nanotechnology was, either.

But they learned about it through Internet research and by visiting the Wilson Center's nanotechnology program, ultimately settling on a project involving a quest for a more comfortable prosthesis to help injured people. The team landed in next year's final competition.

"Everybody should learn what it is," said Leah, an eighth-grader at Longfellow Middle School in Falls Church. "It could be incorporated into science curriculum for different age groups and taught differently. But I think it would be great to teach students about the new science that they might be working in when they grow up."

Chang's university is part of a consortium of 14 museums, research centers and educational outreach institutions also working to educate the public -- inside and outside of schools -- about nanotechnology.

"The informal is very important," said Gerry Wheeler, executive director of the National Science Teachers Association. "Count up the minutes a kid is in the classroom and the kid is outside the classroom. Family involvement, outside learning, is very important."

Museums also are developing exhibits, demonstrations and activities for people of all ages to learn about the field. There's also a proliferation of supplemental materials being created -- including learning modules with ready-made experiments, fact sheets and teaching tips -- that educators can insert into their standard curricula.

That's what Chang has been developing as he directs Northwestern's new national center for the university's Materials World Modules program, charged with creating materials on nanotechnology for students in grades seven through 12.

Part of the goal, Chang said, is that young people will become interested enough to want to enter the field, which he said needs tens of thousands nano-literate workers. Helping kids understand how science directly applies to the quality of their lives is crucial to attracting more workers, he and other scientists said.

It is unclear whether the current array of educational efforts will be enough to accomplish their goals. Wheeler said he doubts it. Supplemental materials and many professional development programs are helpful for some teachers but often don't reach far enough, he said.

"The alpha science teacher does look forward to these new things and finds a way to get the subject into his or her classroom," Wheeler said. "But they really can't put a lot of time into that because of the standards and the testing."

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