

Empowering the classroom with cutting edge nanoscience and technology



The Challenge

In its infancy, nanoscience and technology (NS&T) has already created a burgeoning career field that, according to the **National Science Foundation** (NSF), is expected to generate hundreds of thousands of jobs and an estimated \$1 trillion in worldwide revenues in the next five years. Teachers are challenged with both learning the emerging content, while teaching the curriculum to a new generation of learners in **STEM** (science, technology, engineering, and math) fields.

Strategic Solution

STEM content has been taught for decades, yet teachers must shift the concept of their role from “expert” in front of the classroom, to “guide” alongside learners to remain astride with cutting-edge NS&T—let alone Next Generation Science Standards.

Funded by the NSF, McREL’s **NanoTeach** is creating and testing professional development (PD) that blends instructional strategies from **Designing Effective Science Instruction** (Tweed, 2009) with hands-on learning of NS&T content, using research-proven strategies and inquiry-based practices. The pilot program began in 2010, involving 21 high school science teachers, representing urban, rural, and suburban schools with underserved populations. McREL developed face-to-face and online PD training, and teachers spent two intensive weeks learning how to integrate NS&T into biology, chemistry, physics, and physical science courses.

During the school year, teachers engaged in a lesson-planning process in which they integrated NS&T into existing curriculum, continually refining the content and instructional approaches with the support of McREL staff and researchers from the Stanford Nanofabrication Facility and the Georgia Institute of Technology. Online presentations and panel discussions provided them with tools to inspire students to think of NS&T as integral to their core scientific understanding. After the pilot phase, McREL conducted field tests in four

states. By 2013, nearly 75 teachers participated in NanoTeach, ultimately reaching more than 1,600 high school students.

Results

By engaging teachers in the same learning process they would eventually use with their students, teachers became more confident in their ability to teach NS&T.

“Real-world, cutting across all STEM fields, and packed with opportunity, NS&T is a superbly compelling way for educators to engage students. NanoTeach further empowers those educators with a renewed awareness of the process of learning, supported by an accessible toolbox of pedagogical strategies to make it dynamic and meaningful,” says **Whitney Cobb**, managing consultant for McREL’s Center for Learning Innovation.

Pre- and post-pilot assessments of teachers’ content knowledge showed that they had positive views of NanoTeach’s hands-on activities and inquiry-oriented approach. The study also indicated significant increases in student content knowledge, and higher levels of engagement and interest in science among teachers and students. Post-study curriculum maps showed that teachers successfully integrated NS&T into the curriculum and lessons.

Next Steps

NanoTeach is one of three nano-related programs McREL has developed in recent years. From 2004–2008, McREL developed **NanoLeap**, a collection of instructional materials for teaching nano-concepts in high school chemistry and physical science. McREL is also completing **NanoExperiences**, an all-minds-on-board companion project aimed at increasing student interest in NS&T careers through a dynamic out-of-school time program. McREL plans to focus next on more discipline-specific content and greater collaboration between science teachers and their colleagues in math and technology, as well as helping teachers build a sequence of learning from one grade to the next at the high school level.