For preschoolers, technology means using tools such as crayons and scissors, and science means peering through a magnifying glass or playing with a magnet.

These simple experiences lay an important foundation, said Beth Fredericks, one author of a teaching guide intended to assist preschool educators in focusing and refining the naturally inquisitive behaviors of children ages 3 to 5. And, she said, perhaps that foundation will lead to a career in a chemistry lab.

“Kids lose their love of science and math,” Fredericks said. “They lose their natural sense of curiosity. They stop asking dumb questions that really aren’t dumb.”

The guide, created by the Boston Children’s Museum, is one way that Massachusetts is trying to reverse the disappointing statistic that only 17 percent of high school seniors are interested in math and science, Fredericks said.

Experts say an education in science, technology, engineering, arts and math—or STEAM—is essential to building an innovative workforce in the United States, and the sooner students delve into STEAM education, the better.

Funding for the teaching guide was part of the federal Race to the Top grant program that awarded Massachusetts funding four years ago. Museums in the state received $500,000 to help close the achievement gap in the state. The guide, now in its second edition, has been distributed to more than 100 museums and 200 libraries in Massachusetts, Fredericks said. She estimated that the kit, which encourages educators to use museums and libraries as informal places of learning, has touched the lives of more than 12,500 preschoolers.

“All kids are curious,” Fredericks said. “All kids want to play and explore.”

**STEAM Builds an Innovative Workforce**

Harvey White, a retired technology executive in California and an ardent advocate for adding arts to STEM education, making it STEAM, said traditional education systems, which he likened to production lines in factories, are out of date. He said businesses and their labor force needs may have been well served in the past, but that is no longer the case. According to White, gearing schools up to produce an innovative workforce that is ready for the technology of the future should be a national economic priority.
“I am thinking about my grandchildren and their future,” White said.

The United States went from first to eighth, and then back to fifth, among innovative nations, White said. STEAM, however, can help the country remain competitive. White said he believes that creativity and innovation require right-brain thinking, which is encouraged by studying the arts. “As we have lost manufacturing jobs, the need for an innovative workforce has increased,” he said. “[But] it’s not like it’s too late.”

Taking STEAM to Elementary Students

In a northwestern suburb of Chicago, the Glen Ellyn school district has taken up the charge to radically change schools. The district has introduced STEAM education in all of its elementary schools. Part of the impetus for STEAM came with the adoption of the common core standards in Illinois a few years ago.

“Common core increased the rigor of the curriculum by half to one grade level,” said John Bower, a level three (fourth- and fifth-grade) STEAM teacher at the district’s Abraham Lincoln School. “We had to look at making crosscutting connections between what used to be separate silos.”

Starting in third grade, the day is split into two halves: one half of the day focuses on literacy and the other half on integrated STEAM instruction, using problem-based learning.

Problem-based learning is more than projects, Bower said. Students start with an overarching, real problem. An essential question is formulated, often with student input.

“You want to make sure that you can’t Google the answer to the essential question,” Bower said.

A real-world problem Bower’s classroom worked on last year was how to minimize the effects of flooding they were experiencing at their school. They had to research the issue and find evidence to support alternative solutions. Options proposed included eliminating portable classrooms at the school, creating a rain garden with native wild flowers, creating a catch basin for drainage and adding underground drainage to the school playground. The students developed a budget for the playground drainage and discussed how to get the budget proposal on the school board’s agenda.

Bower said he believes his job is to make math, science and engineering come alive. He said high school, where much of the STEM or STEAM education is concentrated, is too late for students.

“If they don’t think it’s cool and fun in the early years, we lose them by middle school,” Bower said. “I want to make learning fun.”