

# BUILDING A TOOLBOX FOR SCIENCE AND MATH LITERACY

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A report issued in June by the National Research Council emphasizes the importance of science education and recommends ways to improve K-12 education in science, technology, engineering and math, the so-called STEM subjects.

"A growing number of jobs - not just those in professional science - require knowledge of STEM fields," says Adam Gamoran, chair of the NRC committee that produced the report. "We need to help all students become scientifically literate because citizens are increasingly facing decisions related to science and technology - whether it's understanding a medical diagnosis or weighing competing claims about the environment."

But recent test scores indicate that California's students perform abysmally in science, especially economically disadvantaged and minority students, according to Maria Simani, the executive director of the California Science Project and a physicist at the University of California Riverside. She laments that in many schools she sees a lack of advanced science courses and too few students taking them.

Highly integrated with science - whether we like it or not - is a proficiency in math. And learning math is like buying

tools for a project. The American physicist and Nobel laureate Richard Feynman even referred to math methods as "tools."

You would never attempt to build a house without investing in the right tools. In the same way, you wouldn't want to solve a difficult math problem without first understanding some basic concepts and patterns. These are your tools, your tricks of the trade.

Yet students arrive each year in college with math toolboxes so spare that we are learning backward. As a physics major, I didn't have the basic concepts of

standing electricity and magnetism much easier.

I would have appreciated statistics much more had I known that it was largely the foundation of artificial intelligence (AI). In college I took an AI introductory course that I soon found fascinating. We wrote computer programs that took data from the real world and produced a meaningful output. But without a solid grasp of basic statistics, I struggled through the class.

What could have helped me? The answer, I believe, is challenge and early exposure, which often come from mentors, the kind

enough," he said. "If you bring your grade up to an A by the end of the course, I'll buy you a copy of 'Mr. Tompkins in Paperback.'" (In the book, Mr. Tompkins is an everyman bank clerk who encounters the concepts of modern physics through a series of fantastic dreams and adventures.)

Before my professor challenged me, I could have cared less whether I got an A or B. Passing is passing. But now I had to prove to him - and myself - that I could get an A. I studied harder with the intent to get an A (and a free book), steadily

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linear algebra neatly arranged in my toolbox, and neither did many of my peers. Instead, we learned those concepts out of necessity while tackling our quantum mechanics homework. It was like being asked to cook a gourmet meal when we barely knew how to peel potatoes.

At the very least, high school students need to be challenged to be math literate and well prepared for college. Where will the math help you down the line? Calculus is useful to solve standard mechanics problems. A solid foundation in math makes under-

standing my math tools. I practiced the problems again and again, and would not budge until I got them right.

I would not have put in the effort without my professor's timely challenge. What it engendered in me was the curiosity to delve further into physics. And practicing math wasn't so bad. In fact, it paid off.

I got an A in the course, and soon afterward I chose to major in physics. I also got the book.

What did help me in the end was my modern physics course professor, who challenged me with a goal.

One day he told me: "All of the excitement about physics really comes from modern physics, so if you do well in the class and you like the material, you should major in physics."

But then he went further: "What's your grade in this class right now?"

"I think I have a B."

"That's not good

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