

Editorial & Letters

EDITORIAL

The Wake-Up Call We Dare Not Ignore

The science and mathematics education community is still recoiling from the latest results on student performance in the Third International Mathematics and Science Study (TIMSS). Although scores were not expected to be high, the fact that the nation's 12th graders were among the lowest performers was disheartening. TIMSS, the most comprehensive and well-designed international study to date, paints a fair and accurate picture.

U.S. 12th graders performed below the international average and among the lowest of the 21 TIMSS countries that participated in the general science knowledge assessment. And in the advanced physics assessment, U.S. 12th graders performed among the lowest of students from the 16 countries participating.

Earlier TIMSS results showed that American students did well in science at the fourth-grade level, although even then it was not clear that American students had a firm foundation in some basic math and physical science concepts. By eighth grade, our students were losing ground. Although they were above the international average in earth science, life science, and environmental issues, they were about average in chemistry and physics. These earlier TIMSS results foretold a downward trend in performance as students enter the higher grades, but the education community never expected that our best students, those more likely to pursue careers in science, would not measure up to students from most other nations.

The science teacher is the single most valuable resource in the science education equation. There are many dedicated teachers in classrooms across the nation. But they cannot do the job alone. Our greatest challenge is for all of us—teachers, parents, scientists, administrators, business leaders, and policy-makers—to work together to change the system in which they work.

Earlier TIMSS data indicate that when compared to other countries, U.S. teachers lack support throughout their teaching career and feel isolated from their teaching colleagues. They teach more classes per week than their Japanese counterparts, and there is no time set aside in the U.S. school day for teachers to learn from one another and share strategies about teaching. Science teachers also face the challenge of having to teach subjects outside their field of expertise. U.S. Secretary of Education Richard Riley notes that, in the physical sciences, “almost half of American students are taught by teachers without a major or minor in that field.”

Soon after the National Science Education Standards were released in late 1995 (after the TIMSS data had been gathered), the National Science Teachers Association surveyed 5000 randomly selected members on their reactions to standards they had yet to see. When asked if they thought standards would improve the way science is taught in their classrooms, 80 percent of those who answered said yes. But the teachers said they expected to run into barriers when they tried to put standards into practice. The three top barriers cited were the need for adequate time for planning and working with other teachers, financial support for professional development, and adequate science materials, resources, and facilities.

There is a disconnect in the system. Students from around the world come to the United States to receive what is considered the best education in the world. We produce world-class scientists who continue to win Nobel prizes and make extraordinary contributions to many fields of science and technology. Yet at the same time, our universities and colleges fail to effectively train the teachers of our future scientists. We must overhaul the education of science teachers so they enter the classroom with both a strong knowledge of science and effective teaching skills. Schools of education and science departments must work together to provide that training. We must require teachers to take many more courses in science and show them how to direct student learning through inquiry and investigation.

We can certainly point out many shortcomings in the education system that may or may not contribute to the most recent TIMSS results, including the lack of a requirement that students take math and science throughout their K through 12 years and the fact that national and international standards and tests are tougher than those used by many states. However, we are optimistic that finally we are going in the right direction. Science teachers nationwide are working to implement the goals of the National Science Education Standards that provide a clear and concise path for improved science teaching and learning: more emphasis on inquiry science, teaching fewer topics in greater depth, long-term meaningful professional development for veteran teachers, and the involvement of everyone in the process.

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LETTERS

“Duck soup”?

Readers, both scientists and nonscientists, comment on a rich mélange of topics, including

Marx Brothers movies (left, Groucho in *Duck Soup*), genome databases, NMR history, release of crystal structure coordinates, agriculture in resource-poor countries, fractal structures in nature, *Science's* Compass, the pros and cons of public funding of the arts and of science, catching frogs, and education of the deaf.



Unexpected Opportunity?

James Glanz's excellent News article about the possible antigravity force found by astronomers (27 Feb., p. 1298) typifies what I have admired and benefited from in *Science* over the years. It was clear and provided far more enlightening detail than did other news accounts. But I appreciated it all the more when I saw, near the end, that it contained an unexpected opportunity—the chance for me, a lay person, to write in to correct a troublesome error and to do so in the magisterial tone that the letters you publish routinely, and doubtlessly justifiably, adopt. The Marx Brothers movie in which a large number of people show up in Groucho's stateroom (“Do you want your nails long or short?” Groucho is asked by a manicurist who has wandered in. He replies, “Better make them short. It's getting crowded in here.”) is *A Night at the Opera*, not *Monkey Business*, as reported.

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After the Genome Database

An item in ScienceScope of 30 January (p. 645) reports on the imminent closure (on 31 July) of the Genome Database (GDB) project housed at Johns Hopkins University. The database itself, however, will not disappear, but will be publicly available at the same Web address (www.gdb.org), with