

More Than Texts Need Reform in Middle Schools

In his PHYSICS TODAY article (May 2003, page 50), John Hubisz discusses the results of a review of middle-school science texts. I read the Hubisz report¹ when it first came out. The basic premise was accurate; opening a random textbook to a random page was about all it took to find several mistakes.

But has Hubisz done recent homework to check for signs of change? In particular, has he looked for improvement in the textbook selection process in large, influential states? In 2000, California made significant strides toward improving texts.

Hubisz writes, "Publishers aim to satisfy the committees that select texts, even though the members of those committees typically have little knowledge of physical science." My husband, an excellent chemistry teacher, chaired the California Curriculum Commission's science subcommittee and oversaw California's last science book adoption. Every submitted textbook was read first by a content review panel composed of three people, each with a terminal degree in science. Texts were then reviewed more thoroughly by committees of teachers and others. Although a few errors remain in the books that survived to adoption, those errors are much fewer than in previous texts. Some errors persist because of time demands on reviewers and the need to provide teachers and students with tools to meet California's demanding content standards. For the review criteria used, see reference 2.

Yes, texts need to be improved, to become more accurate, more interesting, and less disjointed. Yes, well-crafted laboratory activities need to be encouraged. But more has to happen before all children get a good science education. An important step is to make sure that students can read

well enough to take meaning from those texts. Many can't now, but research-based reading interventions are being developed and implemented. And then the education system will have to deal with pesky student deficiencies in math. These areas especially need improvement if students are to understand and appreciate science.

Another reform that is badly needed, particularly at the middle-school level, is to improve teachers' science content mastery. Even decent books can be undercut if science-ignorant teachers design their own "innovative" lessons. A couple of years ago, I watched students in an eighth-grade class, with their newly adopted textbooks pushed to the side, do an exercise about molecules. The assignment was to take a chemical formula—for example, Fe_2O_3 —and design and color a fanciful molecule based only on the students' artistic vision. One might argue that eighth grade is not the right time to introduce the details of bonding and molecular geometry, but a teacher who knew such things would never have caused students future confusion by assigning this counterproductive exercise.

The problem is multidimensional, and yes, physicists and other scientists should get involved.

References

1. J. L. Hubisz, *Review of Middle School Physical Science Texts*, available online at <http://www.psrc-online.org/curriculum/book.html>.
2. California State Board of Education, *Science Framework for California Public Schools, Kindergarten Through Grade Twelve*, California Department of Education, Sacramento, Calif. (1990), p. 300. Relevant section is available online at <http://www.cde.ca.gov/cdepress/science-framework/science-framework-pt7.pdf>.

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Congratulations to John Hubisz on his fine article and especially for his Herculean efforts to improve an area of our educational system in which our failure has such serious consequences. I am especially dismayed at the preponderance of text-

book errors because my twin daughters will be starting middle school in the fall.

The textbook errors Hubisz reports are indeed remarkable. He also emphasizes the importance of precise language, but language adopted by the physics community contains an interesting dilemma: an apparent distinction between law and theory. Is Newton's law of universal gravitation more fundamental than Einstein's theory of general relativity? This is not merely a semantic distinction, as is evident in the debate over evolution: It is, after all, "only a theory."

The call for physicists to take action is quite appropriate. However, one important component in the equation seems conspicuous by its absence from his discussion. Education colleges, by and large, have not been engines for real educational improvement. In our department, we have had to turn away students who were interested in pursuing graduate degrees in K–12 physics education; our college of education provides future teachers with teaching pedagogy but not physics.

It seems that the only long-term solution for the declining interest in and knowledge of science in the public schools lies in reforming teacher education. Physics departments need to play a significant role in that reform.

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Among the many well-taken points in John Hubisz's article was one less compelling. In box 1 of the article, the answer to the oft-heard lament "Is it too much to ask that middle-school students develop the habit of consulting a dictionary?" should be "yes." Learning science is sufficiently challenging without continual interruptions, and even more difficult is to know what you don't know: Many physics words and names have idiosyncrasies of which young students can hardly be expected to be aware.

Adding pronunciation keys to the difficult words is a practice that might fruitfully be followed by textbook publishers. A few diacritics

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