

don't take up much space and don't detract from sentence flow or meaning, but do give the reader a frisson of distinction—that physics words and names are interesting and different! How better to convey the international scope of the physics enterprise than to teach students that “Planck” is pronounced differently from the experimental apparatus for determining mechanical advantage? Pronouncing words and names as if they were English sets students up for embarrassment.

I experienced such discomfort the first time I said “heterodyne” out loud in front of people who were experienced enough to know which syllable got the accent, but were insufficiently genteel to correct me privately. If students are embarrassed whenever they talk physics, they may be driven to philosophy and spend their days pondering So-crâtes.

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John Hubisz presents an excellent and important review article. The involvement of physicists as volunteers in K–12 classrooms is only briefly mentioned as a solution to science education problems, but is critical in ensuring that all students receive a quality science education.

Textbook and teacher-training reform are necessary, but such slow processes will only show results in the long term. By volunteering in classrooms, physicists can help children learn science today. In close, continuing collaborations with teachers, physicists can help improve teacher self-confidence and easily dispel misconceptions raised by textbook errors. I've had the experience of visiting the same class for several years; the teacher, students, and I have all benefited enormously.

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The article by John Hubisz caught my eye. I found the examples of textbook errors and misstatements amazing and frustrating. The example he gave of a textbook's confusing the terms speed, velocity, and acceleration tells me the textbook writer doesn't come close to knowing the subject. Someone might ask if it really even matters outside of science. I'll illustrate with a quick, real-world example.

Several years ago, I was an expert

witness in a very lengthy lawsuit about a worker who was severely injured when a truck at a paving site backed over him. I was involved because of my background as an acoustical engineer. I dealt with the audibility of the backup alarm and how the sound field was distorted by the manner in which the alarm was installed.

Toward the end of the many depositions (there were five teams of lawyers), an attorney who was working hard to discredit my conclusions asked if I'd measured the wind speed

when I did my testing at the site. I answered yes. He perked up and dug out an old transcript. He asked if I remembered testifying on a particular date, when he had asked me if I had measured the wind velocity and I had said no. He obviously thought he had me on something.

I asked to read the testimony page in question. “What's the problem?” I asked. “Both answers are correct.” None of the lawyers understood, so I explained: “Speed is a scalar quantity. Velocity is a vector; it has two parts—magnitude or



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speed, and direction. Speed and velocity are not the same. Speed does not indicate direction. If you are going to use the terms, I suggest you know their meanings." That pretty much ended the interrogation and the case was settled.

Maybe that lawyer got his science education from one of the poorer textbooks. Would that mean he could sue the teacher, school system, textbook publisher, or author? Let's hope that the statute of limitations has expired.

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In his article, John Hubisz commented on "error-filled physical science textbooks." In particular, he wrote: "Many of the errors involved sloppy use of language . . . as in 'an acceleration is a change in velocity. . . .' Note the use of 'change in velocity' instead of the correct 'change in velocity with respect to time.' That imprecision was a common error." Apparently, this error is found worldwide and in areas other than textbooks.

For example, there was a German court case reported last year in the influential German weekly magazine *Der Spiegel* (issue 16, p. 196, 2002). The article carried the title "Schraube im Nacken," that is, "A Screw in the Nape of the Neck." A whiplash victim had suffered such serious damage to his neck (cervical spine) that he required a few screws to immobilize it permanently. But in the trial, the court expert, a "human biologist and professional engineer (*Diplomingenieur*)," testified that the victim's head had sustained only a change in velocity from "12.4 to 15 kilometers per hour," which was, he said, insufficient to cause such a serious injury. The judge in the case evidently knew his physics better than the court expert. The victim, as I later learned, was awarded €35 000 (about \$40 000) for pain and suffering.

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I endorse John Hubisz's quest to improve textbooks for middle-school science courses and to stress the accuracy of the material. But perhaps emphasizing the good parts of the existing books would provide more immediate progress.

We scientists who have been working with publishers to write middle-school texts have managed to provide