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- DOE/NE-0017-1, US Department of Energy, October 1982, page 261.
3. *Draft Environmental Impact Statement for Standards for the Control of By-product Materials from Uranium Ore Processing* (40 CFR 192), EPA 520/1-82-022, US Environmental Protection Agency, March 1983.
 4. *Environmental Impact Final Statement for Remedial Action Standards for Inactive Uranium Processing Sites*, EPA 520/4-82-013-1, US Environmental Protection Agency, October 1982.
 5. The estimated risks of lung cancer from naturally occurring radon decay products found in homes that are not near mill tailings or any other specifically identified radon source is 4×10^{-6} to 4×10^{-3} (see reference 3, page 6). The issue of health risks posed by elevated indoor radon concentrations resulting from a variety of causes other than mill tailings has been discussed previously in these Letters (PHYSICS TODAY, May, page 102); see also reference 4. Reference to these problems, of course, does not reduce the risks posed by improperly discarded mill tailings.
 6. *Standards for Uranium and Thorium Mill Tailings at Licensed Commercial Processing Sites, Part VI*, 40 CFR 192, U.S. EPA, Federal Register 48, 19584, 29 April, 1983.

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7/83

Role of the teacher

I fully agree with Jerry Finkelstein's belief that the ideas students bring with them to the classroom can furnish a firm starting point from which to develop an understanding of physics (April, page 91).

The teaching of Newtonian physics to Aristotelian minds is a serious problem that has confronted teachers for years. In addition, there is evidence for the persistence of the Aristotelian way of thinking even in adults who have learned Newtonian physics in high school. So my view is that we cannot blame students because they have a predilection for Aristotle's views or a prejudice against Newton's views—they are completely ignorant of these views. But they do express Aristotelian ways of thinking without knowing it and without knowing that they contradict Newtonian physics. In addition, Aristotle's views are at least 2000 years old. Despite our efforts to teach Newtonian physics, we are in trouble because of the persistence of Aristotelian views. The only conclusion I can draw, therefore, is that Aristotle's way is the natural way of thinking, though it has not given birth to the overwhelming developments of physics. If Aristotle

had existed in the 17th century along with Newton, or after that, he would have become aware of Newtonian physics and would have contributed to the developments of physics enormously.

So, instead of suppressing the natural way of thinking, we should teach students to express their ideas systematically and lead them smoothly to the laws of physics by making changes whenever and wherever necessary. Otherwise, as Finkelstein says, students will not believe in us.

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8/83

More on problem solving

Mary Meyer enlivened the June issue (page 92) with her lucid discussion of Robert Fuller's article (September, page 43) on problem solving. They and the references they cite call to our attention some superb insights on the consequential structure of applied thought that is science.

I would like to offer, as support to Fuller's expectation that some such attention to the cognitive processing of disequilibrating experiences (discovery and other such perceptions of universally accessible fact which apparently contradict a dominant depiction of reality) offers benefit to science generally and to its teaching.

Permeating science and the cultures that produced it is the hidden assumption that such problems are individual matters—that salvation, as it were, is a private affair. This seems to be true at least in those domains where the fiction of immense individual accomplishment drives personal strivings for fulfillment through dedicated work; physics is a paradigm itself of such fields of endeavor.

But there is a considerable likelihood bordering upon certainty that unapparent mental constructs involving cognitive resonances of long, broad standing among many, many persons are a (the?) basic phenomenon at work in such fields. The incremental nature of the progress of general understanding and the ubiquity of parallel invention hardly contradict this presumption.

If this is true, then one contributor's misery of cognitive dissonance is a vital ingredient of the next one's exultant resolutions. The *sine qua non* for this to be plausible is communication. I would then submit that science arose upon the foundation of universal publication.

The bearing of all this upon those issues discussed by Fuller, then Meyer,

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