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Editorial

Can the Humanities Help Science?

The confidence level of twenty-first-century American citizens in science is in decline. Whether it's the science of Big Bang cosmology or the theory of evolution or the claims of science about global warming, stem-cell research, green energy, the disposition of nuclear waste, or responding to oil spills, science and its claims are met with increasing skepticism and sometimes even with hostility. Should scientists respond? If so, how?

The answer to the first question, given with some urgency, is "yes." The standard answer to the second question is twofold: improve science education for schoolchildren and increase educational opportunities that bring science to the general public. Given the historical realities, however, these answers are discouraging.

For decades, individual scientists with a passion for teaching have sought successful instructional strategies, so successful, in fact, that they would be adopted by instructors generally. There have been localized successes, but nothing has been attractive enough and persuasive enough to have a national impact. The efforts go beyond individuals. For decades, scientific associations—the National Academy of Sciences, the American Institute of Physics, the American Physical Society, the American Association of Physics Teachers, the American Association for the Advancement of Science, and others—have mounted program after program designed to improve science education, and all the while American students have slowly descended towards the bottom of international rankings of proficiency in science. Since 1960, enormous amounts of money, from both private and public sources, have been spent on science-education initiatives and there has been little-to-nothing to show for it.

Even more disappointing is that physics education research (PER), a research field that began in Europe and the United States, has now been going on since the late 1970s. Many papers have been written, but the results of this research have not given American students a boost upward in the international rankings. Have there been surprises, any stunning surprises, coming out of thirty-five years of PER? No surprises significant enough to influence physics instruction in any general sense.

Over fifty years have been devoted, through a variety of efforts, to improve science education in the United States, and yet American students do not compare well with students from other developed countries.

We can ask a similar question about the past and present efforts to improve public understanding of science, but that is another big subject.

To the best of our knowledge, no consideration has been given to the humanities as a means of improving the standing of American students in the international rankings of science proficiency. We believe a greater emphasis on the humanities for science students is a worthy consideration.

Universities are sometimes called a "community of scholars"; in fact, today's university is hardly a community except in the sense that a group of people work in close proximity to one another. There is almost no interdepartmental cross talk and little intradepartmental cross talk, at least cross talk of a substantive nature. University faculty members are like stalactites—a form of drip stone—hanging from the ceilings of limestone caves, each isolated from all others. How often do physics professors get together with their colleagues in the humanities and talk about their respective interests, their problems, and their successes? How often do physics professors regard the subjects of history, literature, and the fine arts as having something to contribute to students majoring in physics and advise them accordingly?

We suggest that the humanities have much to offer science students; further, we believe that educational breadth enriches depth. It is possible that a student's experiences in a literature or history course, for example, may improve performances on international tests and that U.S. students will begin to compare more favorably with students from other nations.

One of us (JSR), twice taught a one-hour course in the physics department at the University of Maryland in College Park. Each week a nonacademic physicist spoke to students about how their physics education played into their careers. Whether the featured physicist was from large or small industry, government, the military, a consultant, or a self-employed entrepreneur, almost without exception, each made one recommendation to the students and each made it with strong emphasis. Each said, *learn to write*.

Most students go through an entire physics education without ever writing a paper, or even a paragraph, in common English words. A course in literature and one in history would provide a student with the opportunity to write papers that are free of technical jargon. Courses that emphasize writing skills are strongly correlated with the growth of critical thinking abilities. In addition, a literature course would alert students to the power of words and broaden their concept of reality beyond the material world. A history course would put physics in a context that would enrich physics itself. Current students are products of the Enlightenment. Do they appreciate how science and especially Isaac Newton stimulated that ground-shifting period that continues to shape contemporary values?

As the University of Maryland course starring nonacademic physicists demonstrated, physics is a wonderful gateway to a technical career. Everyone, we believe, agrees that education serves a greater purpose than merely a career—important as that is. Education should liberate; that is, education should free students from the shackles of "not knowing": not knowing a few great writers, not knowing the history that made them who they are, and not coming to know how

great art can bring a new perspective to both the outer world of nature and the inner world of self. We encourage physicists to guide their students toward a more complete and richer education.

John S. Rigden
Roger H. Stuewer