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# Scientific Literacy

**Jane Maienschein with students***

Reinforced by the dismal U.S. performance on the Third International Mathematics and Science Study (TIMSS), deploring our lack of scientific literacy has become quite popular recently. By the broadest definition, more than 90% of Americans are scientifically illiterate—an appalling statistic by anyone's standards and possibly a threat to our well-being. Yet with all this agreement we see astonishing ambiguity—and two different definitions of scientific literacy. The first emphasizes practical results and stresses short-term instrumental good, notably training immediately productive members of society with specific facts and skills. We call this *science literacy*, with its focus on gaining units of scientific or technical knowledge. Second is *scientific literacy*, which emphasizes scientific ways of knowing and the process of thinking critically and creatively about the natural world. Advocates of the second assume that it is good to have critical thinkers, that scientific literacy is an intrinsic good—on moral and other principled grounds. Being scientifically literate helps people to live "good" lives (in the philosophers' sense of reflective and fulfilling, and not in the distasteful sense of eating good-for-you bran flakes). According to this view, science is beautiful, exciting, and fun. Becoming scientifically literate produces skeptical, creative habits of mind that are valuable for everyone.

**Scientific literacy provides a necessary but not sufficient basis for making informed social decisions.**

The two approaches are often in tension and have different implications for education, testing, and public funding of science. Promoting scientific literacy requires a new way of teaching for which few teachers are prepared. It stresses long-term process over short-term product and questions over answers. The student may possess less knowledge, but has skills for adapting to the challenges of a rapidly changing world.

Political leaders and educators resist working toward the long-term goals of scientific literacy because of pressures to generate immediate outcomes such as higher test scores or more people with B.A.'s trained for technical jobs. In contrast, we advocate integrating the short-term goals of knowing science (facts and skills) and the long-term goals of scientific literacy. We must have a society rich in both critical, creative scientific thinkers and enough knowledgeable experts to do today's work.

We need both science literacy and scientific literacy for effective participation in the real world. Some people do need specific information, but informed decision-making is a social process and also requires a society of scientifically literate thinkers to make wise choices and to help combat racism, sexism, bigotry, and social injustice by allowing us to distinguish reliable scientific information from unsubstantiated claims and pseudoscience.

Scientific literacy improves decision-making when we select a doctor or medical treatments. It teaches us to ask why we should take the entire course of an antibiotic, and why that antibiotic will someday be replaced by something different. It shows why simplistic genetic explanations of disease perniciously promote false expectations and dangerous decisions. It encourages constantly seeking to know more, as well as a willingness to embrace revision as what is known one day is replaced with something quite different, and provides approaches for sorting through and selecting among competing alternatives.

Scientific literacy provides a necessary but not sufficient basis for making informed social decisions. Because science is a process carried out by humans who work in a social context, that recognition must be a central part of our science education. We must not pretend that science is a pure and absolutely objective pursuit, insulated from all social forces. We should expect controversy and disagreements, then develop the critical habits of mind to deal with them. We seek scientific literacy, in this sense, for everyone.

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