Achieving Public Understanding of Research in Developing Countries

Bruce V. Lewenstein

[摘 要] 在发达国家关于“科学素养”的讨论中，大众科学知识的核心通常是指科学家定义的物理学、化学、生物学等。2002年12月在南非开普敦举行的研讨会上，研究人员和实践者认为，发展中国家的公众对研究的理解更多地与一些基本问题相关：为公众提供清洁的饮用水、让公众了解未采取安全措施的性生活与艾滋病毒感染之间的必然联系等等。发展中国家促进公众对研究的理解的各种项目必须面向弱势群体，必须努力消除社会阶层与地域间的不平等。科学技术资源的分配在政策上不应无视差别地一概而论。

[关键词] 科学素养 公众理解科学 发展中国家

Abstract: In the developed world, discussions about “science literacy” often focus on public knowledge of science as scientists define it: physics, chemistry, biology, etc. At a workshop held in Cape Town, South Africa, in December 2002, researchers and practitioners suggested that public understanding of research in developing countries is about much more basic issues: providing clean water for drinking and cooking, learning the essential link between unprotected sexual intercourse and HIV infection, and so on. Programs to support public understanding in developing countries must serve the disadvantaged, must work to overcome social and regional inequalities. Choices about how to allocate scientific and technological resources are not politically neutral.

Key words: science literacy; public understanding of science; developing world

This project supports a workshop to explore “the public understanding of research” in developing countries. The workshop will be scheduled for 8–9 December 2002 in Cape Town, South Africa, immediately following the 7th International Conference on Public Communication of Science & Technology, titled "Science Communication in a Diverse World." The workshop will bring together scholars and practitioners from around the world, with special emphasis on participation from the developing world; a substantial fraction of the proposal's request is for funding for participants who would otherwise not be able to participate in an international workshop. The workshop will focus on two inter-related issues: (1) the differences between public understanding of science and public understanding of research, and (2) the differences between a traditional deficit model of science communication and newer contextual, lay knowledge/expertise, and participation models of science communication.

Conceptual background

In the years after World War II, efforts to address public understanding of science were often motivated by an equation of "understanding" with "appreciation" ——greater public understanding meant greater public appreciation of the benefits that science would provide to society (Lewenstein 1992). That led to many efforts to improve public understanding of science by providing more information about science. These efforts were motivated by a belief that if the public only knew more, it would support science more (both materially through political support and intellectually through more skeptical attitudes to "bad science"). This approach has come to be called the "deficit" or "linear dissemination" model, one in which it is assumed that the public has a deficit of scientific knowledge, which must be filled by more and better dissemination of appropriate-

ly written and produced scientific information (Hilgartner 1990; Ziman 1991).

But as a variety of scholars have shown in the last decade, public understanding is a much more complex thing. Several factors are critical:

The equation of science and technology leads to tension between "good" knowledge and "bad" effects. Science has often been "sold" on the basis of its ability to generate new technologies, including medicines, energy sources, space exploration, materials, and information processing tools (Nelkin 1995). But those technologies are not uniformly perceived as inherently good, and in their implementation many have led to highly publicized events that are perceived as damaging to individuals or the environment ——such as the space shuttle Challenger explosion, the Chernobyl and Three Mile Island nuclear accidents, the Bhopal industrial chemical accident, the Jesse Gelsinger gene therapy death, frequent computer-virus attacks, concerns about privacy of computer-based information, and so on. Members of the public recognize the disjunction between claims that science is inherently good because of its ability to generate technologies, and a reality in which technologies are not necessarily good. It is this disjunction, rather than any perceived dangers of science itself, that lead to public distrust in science even as members of the public recognize the benefits that science can provide (LaFollette 1990; Office of Science and Technology and Wellcome Trust 2000).

The contexts in which people encounter science often make issues of institutional trust and credibility paramount in how people assess science. "Science", as an abstract concept, does not exist for most members of the public. Rather, they encounter scientific knowledge and science-based institutions (especially industries) in a variety of contexts, ranging from the workplace to schools to doctors´ offices to political debates. In those contexts, people's assessments of scientific knowledge cannot be separated from judgments about the previous behavior of the institutions and ideological commitments (for example, rejection of a government role in personal health behavior, or commitment to "green" environmental action). In this conception, public understanding is less about knowledge than about assessments of the institutional place of science (Irwin and Wynne 1996; Yearley 2000).

The contexts in which people encounter science are often ones in which lay people have relevant knowledge that scientific experts do not have. When families face dread diseases or farmers face uncertainties about new crops, they bring their own knowledge and experience to the situation. A family may know that Aunt Nell's relatives have a long tradition of "giving in" to cancer, and that therefore she will be unlikely to be willing to undertake a particularly aggressive treatment regime, no matter how a physician presents the statistical risks and benefits of the treatment. Or a farmer may know that water runoff collects along one side of his fields, and therefore suspect that airborne contaminants that have dusted his crops are probably more highly concentrated on that edge rather than being evenly spread as scientific models might imply. Sociologists of science have called attention to this "local knowledge", and contrasted it with theoretical knowledge brought to local contexts by scientific experts. In many cases, local knowledge may be as relevant to appropriate decisions as systematic theoretical knowledge (Wynne 1991; Irwin and Wynne 1996).

In a world committed to democratic action, relinquishing authority to scientific experts runs counter to prevailing values. The essential tension for science in modern democracies is the tension between scientific expertise and public control. Scientists are committed to the belief that properly developed and tested knowledge of the natural world provides the best possible guide for action. Producing that knowledge, and often understanding it fully, requires levels of education and commitment far beyond what most members of the public can achieve. Yet at the same time, science has achieved its many successes precisely because of the freedoms associated with a democratic society in which open debate, meritocratic access to resources, and broad participation are perceived as fundamental criteria for the development of new knowledge (Hollinger 1983). Scientists can not claim those values for themselves without appearing hypocritical if they do not allow members of the

public with the kinds of local knowledge described above full participation in the direction of scientific policy itself, as well as in public policy decisions that are based on scientific knowledge (Sclove 1995).

Together, these issues (supported by a host of more specialized studies) have led to the development of a new models of public understanding of science, ones that stress the need to move beyond "deficit/dissemination" models of scientific information and look at ways of integrating public participation into various levels of scientific debate (Wynne 1991; Ziman 1991; Irwin and Wynne 1996; Gregory and Miller 1998). Some of the activities and ideas associated with these approaches include websites or brochures that distinguish between the "general" public and more specific publics focused on particular issues or encountering science in particular settings (the "contextual model"), such as booklets on the relationship between drugs and brain function targeted at low-literacy adult audiences (who often face challenges associated with drug addiction) (Baker 1995); new approaches to providing "a place at the table" for relevant advocacy groups in the direction of particular areas of research (the "lay expertise model"), as has happened in breast cancer and AIDS research (Epstein 1996); and creating new forums for public engagement in policy issues (the "participation model"), such as public consensus conferences on genetically modified foods, a technique that has been applied in a variety of countries (Einsiedel, Jelsøe et al. 2001).

In addition to these new models of science communication, researchers are returning to an issue identified in many definitions of "science literacy" (Miller 1983; Project 2061 1989; Bybee 1997): the difference between scientific facts and the scientific process. Virtually all commentators, whether coming from the perspective of working scientists (see, for example Wolpert 1992) or sociology of science (Collins and Pinch 1993), have highlighted the importance of helping nonscientists understand the ways in which scientists work and draw conclusions, the habits of mind and practice that lead to reliable knowledge about nature. To that end, the National Science Foundation has in recent years created a program that focuses on public understanding of research rather than public understanding of science (Field and Powell 2001).

What's missing in the new work

The new models of public understanding have emerged largely in research conducted in highly developed industrial countries, especially the United Kingdom and the United States. They assume that people are making personal or policy decisions in contexts in which essential human needs have been met, and where the choices involve access to information, political or social power, and respect for differing social values. In the developed world, debates about nuclear power or genetically-modified foods take almost for granted that access to energy or nutritious meals is not fundamentally at stake.

But for much of the world, "public understanding of science" is about much more basic issues: producing and protecting clean water for drinking and cooking, access to pharmaceutical treatments for infections, malaria, or tuberculosis, creating infrastructure for public health systems to nurture pregnant women and then their newborn children. Public understanding of science is about learning the essential link between sexual intercourse and HIV infection, or between boiling and filtering water and avoiding cholera or other widespread diseases (Jasanoff 1996). In the developing world context, it is not clear that consensus conferences about genetically-modified foods, or museum exhibits about electrical phenomena, or magazine articles about in-vitro fertilization can address the needs of most members of the population.

To give just two personal examples. In 1996, I visited the newly-opened Indonesian Science and Technology Center in Jakarta, a 24,000 sq-meter, 3-story facility. A memo I wrote afterwards reported that "the science museum is open, but still only partially full. It has about 200+ exhibits.... A few of these appear to be designed for interactive science museums, but many appear to be last year's trade show booths, ranging from a BMW exhibit touting its new aluminum drive shaft to a British defense contractor's exhibit on the lethality of its missiles." On that same visit, I walked through slums with open sewers and begging children. A science

museum built on the developed-country model, especially a museum in a country ranked as "severely indebted"by the World Bank (www.worldbank.org/data), simply didn't have the funds to be a very good "developed country" museum, nor did it have the perspective to address the needs of its own country. If museum directors had been able to consider newer models of science communication, a more successful institution might have been designed (Schiele and Koster 2000).

In July 2001, during a class on science journalism in Johannesburg, South Africa, a student from one of the rural provinces asked me how to talk about HIV infection. "In my community, it is taboo to talk about sex," he said. "In our language, we do not even have words for ' penis ' and' vagina'. How can I explain how to avoid HIV infection when I don't even have words for explaining the acts that lead to infection?" Public understanding of science in his community is not about acquiring greater political power or greater facility with scientific instruments; it is about addressing fundamental barriers to scientific information, barriers not caused by ignorance or hostility, but by the core conditions of the developing world — language, poverty, lack of public health, lack of economic infrastructure. It is not clear that any of the models discussed above address the issues relevant to public understanding of science in his community.

The need to adapt new models to developing countries

The conceptual developments in the public understanding of science field suggest that attempts to address the needs of the developing world simply by "filling the deficit" of poor knowledge are likely to fail. But it is not clear how "contextual," "lay expertise," or "participation" models can operate in situations where basic literacy, exposure to scientific approaches, or stable democratic structures are not in place. It seems likely that the public understanding of science "problem" is simply not the same in developing countries as in the developed world. How can websites or brochures target specific audiences if huge proportions of the audience are neither literate nor able to access interactive Internet-based media? How can "lay expertise" (for example, community-based knowledge of traditional remedies) be integrated to scientific understandings when most of the population has no access to even basic health care? How can complex mechanisms of public participation in policy debates be built when basic issues of fair voting and democratic representation are hobbled by inefficient, corrupt, or ethnically-based rivalries and leaders? The context in developing countries may be so substantially different than the developed world that the new models may be incorrect or inappropriate. At the very least, they need review to see how they fit into contexts in which core concerns about public health, access to technological resources, and basic literacy are key elements of everyday life.

The scope of questions to be asked is vast if we are trying to adapt the new models of public understanding to the developing world. What levels of knowledge are already there? What attitudes toward modern science and technology exist? What meanings do science and technology have in developing countries? What activities are already in place? What has been the response to those activities? What impact have they had? Which issues are primary: public health issues, environmental pollution issues, access to pharmaceuticals or access to information technologies? Do the concerns with models of science communication fit the needs? What about the distinctions between public understanding of science and public understanding of the research process—do they have meaning in communities without even a semblance of universal education?

Because the scope of questions is so large, it seems inappropriate to begin with a specific research project. Instead, this proposal is to bring together a collection of knowledgeable practitioners (of public communication of science and technology), scholars, and scientists in a workshop setting to explore the issues and to build networks and collaborations that can lead to innovative public understanding projects and research. The definite outcome of the workshop will be a series of brief "opinion pieces" identifying some of the issues, which will be distributed via a website. Insofar as successful collaborations are created, more substantial papers, research projects, and activities intended to address public understanding of science and research will emerge.

References

[1] Baker, C. (1995). The Brain Book: Your Brain and Your Health. Washington, DC, American Association for the Advancement of Science.

[2] Brossard, D., B. Lewenstein, et al. (in revision). "Scientific Knowledge and Attitude Change: The Impact of a Citizen Science Project." Science Education.

[3] Bybee, R. W. (1997). Achieving Scientific Literacy: From Purposes to Practices. Portsmouth, NH, Heinemann.

[4] Collins, H. M. and T. Pinch (1993). The Golem: What Everyone Should Know About Science. Cambridge/New York, Cambridge University Press.

[5] Crumpton, A. (2000). Documenting Post-War Activist Science. History of Science Society Newsletter: 4.

[6] Einsiedel, E., E. Jelsøe, et al. (2001). "Publics at the technology table: The consensus conference in Denmark, Canada, and Australia." Public Understanding of Science 10 (1) : 83–98.

[7] Epstein, S. (1996). Impure science : AIDS, activism, and the politics of knowledge. Berkeley, University of California Press.

[8] Field, H. and P. Powell (2001). "Public Understanding of Science versus Public Understanding of Research." Public Understanding of Science 10 (4) : 421–426.

[9] Greenberg, J. and B. Lewenstein (2001). Using Closed Captioning to Archive Science & Technology on TV: a Case Study. 6th International Conference on Public Communication of Science & Technology, Geneva, Switzerland, CERN.

[10] Gregory, J. and S. Miller (1998) . Science in Public: Communication, Culture, and Credibility. New York, Plenum.

[12] Hilgartner, S. (1990). "The Dominant View of Popularization: Conceptual Problems, Political Uses." Social Studies of Science 20 (3) : 519–539.

[13] Hollinger, D. (1983). "The Defense of Democracy and Robert K. Merton´ s Formulation of the Scientific Ethos." Knowledge and Society 4: 1–15.

[14] Irwin, A. and B. Wynne, Eds. (1996). Misunderstanding Science? The Public Reconstruction of Science and Technology. Cambridge, Cambridge University Press.

[15] Jasanoff, S. (1996). "Is Science Socially Constructed — And Can It Still Inform Public Policy?" Science and Engineering Ethics 2 (3) : 263–276.

[16] LaFollette, M. C. (1990). Making Science Our Own: Public Images of Science, 1910–1955. Chicago, University of Chicago Press.

[17] Lewenstein, B., R. Bonney, et al. (forthcoming). Measuring Scientific Knowledge and Attitudes in Citizen Science. Perceptions of Biotechnology: Public Understanding and Attitudes. J. Miller, Hampton Press.

[18] Lewenstein, B. V. (1992). "The Meaning of ´ Public Understanding of Science´ in the United States After World War II." Public Understanding of Science 1 (1) : 45–68.

[19] Miller, J. D. (1983). "Scientific Literacy: A Conceptual and Empirical Review." Daedalus 112 (2) : 29–48.

[20] Nelkin, D. (1995). Selling Science: How the Press Covers Science and Technology. New York, W. H. Freeman.

[21] Office of Science and Technology and Wellcome Trust (2000). Science and the Public: A Review of Science Communication and Public Attitudes to Science in Britain. London, Wellcome Trust.

[22] Project 2061 (1989). Science for All Americans. Washington, D.C., AAAS.

[23] Schiele, B. and E. H. Koster, Eds. (2000). Science Centers for this Century. St. Foy, Quebec, Editions Multimondes.

[24] Sclove, R. (1995). Democracy and Technology. New York, Guilford.

[25] Wolpert, L. (1992). The Unnatural Nature of Science. London, Faber and Faber.

[26] Wynne, B. (1991). "Knowledges in Context." Science, Technology & Human Values 16 (1) : 111–121.

[27] Yearley, S. (2000). "Making systematic sense of public discontents with expert knowledge: two analytical approaches and a case study. "Public Understanding of Science 9 (2) : 105–122.

[28] Ziman, J. (1991). "Public Understanding of Science." Science, Technology & Human Values 16 (1 (Winter)) : 99–105.

作者介绍

布鲁斯·莱文斯坦，美国康奈尔大学科学传播副教授。 E-mail:b.lewenstein@cornell.edu。