TEACHING PCST: PROVIDING GLOBAL PROFESSIONAL DEVELOPMENT OPPORTUNITIES THAT RECOGNIZE LOCAL CONTEXT

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Worldwide, public communication of science and technology is increasingly recognized as an exciting and essential interdisciplinary field of study and research. In many developing countries there is a growing government support for public communication of science and therefore demand for science communication professionals at organizations like science centers, science councils and universities. Consequently there is a growing need for professional development opportunities in the field of science communication. This paper presents an attempt to meet that need by offering a distance-learning course from August to November 2005 that brought together students from Cornell University (USA), Fiocruz (Brazil), and SAASTA/Univ. of Pretoria (South Africa). The course was designed to review appropriate literature, develop case studies, and explore training possibilities in the field. The course was designed to give students a chance to discuss both theoretical and practical issues with science communicators in differing contexts.

I. Introduction. "Public understanding" programs should be different in the developing world

"Science literacy" is generally believed to be a good thing. Living in a modern world infused with science and technology, it seems obvious that more people should understand scientific research and how to use it to make life better. In developing countries, modern science and technology offer hope for addressing crushing needs of nutrition, public health, safety, and shelter.

But when something seems obvious, that's the time to start questioning. In early December 2002, a 2-day workshop in Cape Town, South Africa, found that new definitions of science literacy are needed to ensure that public communication of science and technology address the needs of people and societies in the developing world.

The workshop (www.PCSTNetwork.org/PURWorkshop), funded by the U.S. National Science Foundation and South Africa's Foundation for Education, Science & Technology, brought together more than 50 people from 16 countries and six continents. We were journalists, scientists, museum and science center staff, policy analysts, community outreach coordinators, and academic researchers who study science popularization. We all believed in "public understanding of research" – understanding of the scientific process and of the results of cutting edge work.

What we didn't know was whether our vision of what makes a good public understanding program had any relevance in the developing world.

Discussions of public understanding in the developed world often focus on three kinds of science literacy: practical, civic, and cultural. They assume that people are making personal or policy decisions after essential human needs have been met; choices about science-based issues then depend on better ability to use complex information, rather than being constrained by political or economic inequalities. In the developed world, debates about nuclear power or genetically-modified foods take for granted that access to energy or nutritious meals is not fundamentally at stake, and that individuals have the ability to make meaningful choices. Moreover, developed world scientists take as a given that science is a fundamental part of modern culture – one can no more claim to be "cultured" if one ignores science than if one ignores music or art. Even the definition of science in the developed world often seems unproblematic: science is the product of cutting edge research conducted by the methods and techniques that have emerged from Europe since the seventeenth century.

But for much of the developing world, public understanding of research also includes utilitarian aspects: 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 research needs to include learning the essential link between sexual intercourse and HIV infection, or between boiling and filtering water and avoiding cholera or other widespread diseases. In the developing world context, consensus conferences about genetically-modified foods, or museum exhibits about electrical phenomena, or magazine articles about in-vitro fertilization might not necessarily address the practical needs of most members of the population. Nor is the place of indigenous knowledge clear in discussions about public understanding of research in developing countries.

To give just one example: In 2001, during a class on science journalism in Johannesburg, South Africa, a student from one of the rural districts asked one of us [BL] how to talk about HIV infection. "In my community, it is taboo to talk about sex," he said. "In our language, we cannot even use the 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 the latest immunological results, nor 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 – local languages, poverty, lack of public health, lack of economic infrastructure.

The workshop in Cape Town found that it had to redefine the basic terms. In the developing world, the prevalence of indigenous knowledge and local concerns means that public understanding of research is about understanding the process of knowledge production, whether that knowledge is codified in local terms or in the idiom of modern science. The developed world has the luxury of detached interest in reliable knowledge about the natural world; public understanding in the developing world must focus on knowledge upon which one can act, now.

Some of our conclusions for how to address public understanding of research in the developing world were practical ones; not necessarily new, but good solid advice always in need of repeating and reinforcing: create databases of successful projects and opportunities for training, improve access to web-based materials (such as those on SciDev.net), provide ongoing support to people and projects. Some of our conclusions reinforced the continuing need to evaluate the effectiveness of particular programs and to recognize that there is no one "best" practice, as all projects need to be adapted and used in particular local contexts.

But our more far-reaching conclusions forced us to redefine science literacy. Instead of "practical science literacy," Nalaka Gunawardene, a veteran science and environmental journalist from Sri Lanka, talked about defining public understanding as "the minimum knowledge to make life better," to think in terms of survival, of preventing dehydration of babies, of campaigning for better road safety, of promoting safe use of pesticides.

Similarly, "civic" science literacy looks different in the developing world. Carlos Setti, a Brazilian science writer, reminded us of the gaps between rich and poor in developing countries and urged us to always put public understanding programs "at the service of overcoming social and regional inequalities" – a reminder that choices about how to allocate scientific and technological resources are not politically neutral.

But in the end we still believed that research – including open and honest appraisal of the reliable knowledge collected in indigenous knowledge systems – offers tools of great value to the developing world. Thus, we continued to believe in the value of public understanding of research for local culture, and thus believed in the need to convey the excitement of research, especially to young children. Recruiting the next generation of scientists is as critical, perhaps more critical, to the culture of the developing world than to the developed world. It is scientists and citizens embedded in their own cultures who will use the tools of research and knowledge to respond to their own needs and aspirations. Public understanding of science and research is fundamental to cultural future of the developing world.

II. Implementation

One way to help implement the ideas discussed at the 2002 workshop, we agreed, would be to foster discussions between science communication students in different countries. With the emergence of new technologies for distance learning, we believed that it would be possible to create course materials, online discussion spaces, and real-time videoconferences for the students to interact with each other.

With support from our own institutions as well as from the U.S. National Science Foundation, we met in Ithaca, NY, in October 2004 to plan the course. We were joined by several students from the United States, as well as visiting teachers from South Korea and Switzerland. We also had teleconferences with science communication teachers in the United Kingdom and Nigeria. The three lead instructors (authors of this paper) met again in Rio de Janeiro in April 2005, during the 4th World Congress of Science Centres. We mention these meetings to stress the importance of personal contact in planning a course.

The course was planned for four 3-day periods in late 2005. The dates were picked to allow students with fulltime jobs to take small amounts of time from their regular responsibilities. The sites needed to coordinate holiday schedules (different in each country) as well as time zones. (In August and September 2005, Ithaca and Rio were 1 hour apart, while Pretoria was 6 hours from Ithaca. In October, Ithaca went off summer time and became 2 hours behind Rio; in November, Rio went *on* summer time and became 3 hours earlier than Rio.)

The greatest challenge proved to be the idea of videoconferences. Although each site had access to some videoconferencing resources, the technological systems were not compatible (some sites were "Internet" or IP-based, other sites were "telephone" or ISDN-based).

In the end, the course was held in four 3-day segments, August-November 2005. Some days included live audio or videoconferences between Cornell University (Ithaca, NY, USA), Museu da Vida/Casa de Oswaldo Cruz/Fiocruz (Rio de Janeiro, Brazil) , and University of Pretoria (Pretoria, SA). Other days involved taped lectures (available for digital download) followed by discussion locally or via distance technologies, guest lectures both locally or via distance technology from Europe.

Each of the sites organized local activities, including lectures provided by the national coordinators and their collaborators, as well as from local science communicators. In both Brazil and South Africa, some of the students who were themselves already professional practicing science communicators (including museologists, clowns with an informal science education project, journalists, and press officers) shared their experiences. This allowed the individual sites to raise local issues and to compare science communication in the global context with science communication in local context.

III. The topics covered

The course description stated that "Worldwide, public communication of science and technology is increasingly recognized as an exciting and essential interdisciplinary field of study and research. In many developing countries there is a growing government support for public communication of science and therefore demand for science communication professionals at organizations like science centers, science councils and universities. Consequently there is a growing need for professional development opportunities in the field of science communication. This course was designed to review appropriate literature, develop case studies, and explore training possibilities in the field."

The following topics were delivered via taped video lectures (available from BL). Readings were identified to support the lectures, though distribution of the readings did not always occur in time to be useful for students

Unit I: Introduction to science communication

Taped lectures

Public communication of science and technology

Models of science communication

Readings

- Lewenstein, Bruce V. 2001. Who produces science information for the public? In Free-Choice Science Education: How We Learn Science Outside of Schools, edited by J. Falk, E. Donovan and R. Woods. New York: Teachers College Press.
- Brossard , Dominique, and Bruce Lewenstein. 2004. Assessing models of outreach in ELSI projects -- Report to the DOE's ELSI program. Ithaca, NY, USA: Cornell University, Department of Communication. [Selections]
- Lewenstein, Bruce V. 1995. From Fax to Facts: Communication in the Cold Fusion Saga. Social Studies of Science 25 (3):403-436.

Unit 2: Science, communication, and culture

Taped lectures

Science literacy: Is it the same in developed and developing countries?

Culture scientifique

Readings

- National Science Board. 2000. Science and Technology: Public Attitudes and Public Understanding. In Science & Engineering Indicators--2000. Washington, D.C.: U.S. Government Printing Office. (available at http://www.nsf.gov/statistics/seind00/access/toc.htm#chapter8; later editions are available at http://www.nsf.gov/statistics/pubseri.cfm?TopID=9&SubID=34&SeriID=49)
- Lewenstein, Bruce. (2003). A Developing World Take on Science Literacy [website]. 8 January 2003. Available from http://www.scidev.net.
- Lewenstein, Bruce V. (1996). "Que Tipo de Programas de 'Compreensao da Ciência pelo Público em Geral' Melhor Servem uma Democracia? [What Kind of 'Public Understanding of Science' Programs Best Serve a Democracy?]." In Ciência E Democracia [Science and Democracy], edited by Maria Eduarda Gonçalves, 311-330. Lisbon: Bertrand Editora. (An English version was published in 2001.)
- Kirby, David A. 2005. The Devil in Our DNA: A Brief History of Eugenic Themes in Science Fiction Films. In The Narratives of Genomics, edited by P. Wald and J. Clayton.

Unit 3: The challenges of specific contexts

Taped lectures

Science museums and science centers

What to communicate about emerging technologies?

Readings

- Selections from Chittenden, Dave, Graham Farmelo, and Bruce V. Lewenstein, eds. 2004. Creating Connections: Museums and the Public Understanding of Current Research. Walnut Creek, CA: Altamira Press.
- Lewenstein, Bruce V., and Steven W. Allison-Bunnell. (2000). "Creating Knowledge in Science Museums: Serving Both Public and Scientific Communities." In Science Centers for This Century, edited by Bernard Schiele and Emlyn H. Koster. St. Foy, Quebec: Editions Multimondes.
- Lewenstein, Bruce V. 2005. What counts as a "social and ethical issue" in nanotechnology? Hyle: International Journal for the Philosophy of Chemistry 11 (1):5-18. (Available online at http://www.hyle.org/journal/issues/11-1/lewenstein.htm)

Unit 4: Integrating science communication with policy, politics, and culture

Taped lectures

What do people take away from PCST?

Science communication and science policy

Readings

- Falk, John H., and Lynn D. Dierking. 2002. Lessons without limit: how free-choice learning is transforming education. Walnut Creek, CA; Oxford: AltaMira Press.
- Selections from Thomas, Jeff, and Steve Miller. 2003. Political Initiatives in Science and Society Module, Raising Public Awareness of Science, ENSCOT (European Network of Science Communication Teachers, http://www.enscot.eu.com/)
- "Tuskegee Syphilis Study," http://en.wikipedia.org/wiki/Tuskegee_experiment
- Thomas, Stephen B., and Sandra Crouse Quinn. 1991. The Tuskegee Syphilis Study, 1932--1972: Implications for HIV Education and AIDS Risk Programs in the Black Community. American Journal of Public Health 81 (11):1498-1505.

IV. Evaluation

Both South Africa and Brazil conducted evaluations after the course was completed.

South Africa

Overall, over 80% of respondents ranked the material quite or very relevant to their work. All participants considered the program to be effective. Almost 90% said they had changed the way they work in light of the program and almost 80% said they were now more confident in their ability to perform their job. Even the most experienced science communicators, who had been working in the field for over 15 years, indicated that they had changed the way they work since starting the course.

67% found the use of technology e.g. for video lectures to be useful and interesting. However, many also ranked some of the specific US video lectures (particularly in Module 1) as the least useful parts of the program.

Over 80% of the group thought that it was important or very important to have local speakers as part of the training. All participants considered the course content appropriate to the South African context though there is still room for some improvement.

Typical general comments from participants include:

> *"On the whole, I admire the way you bring together such a diversity of experts in the field. It is a real privilege, and very inspiring. I think we are getting a very broad overview. Thank you!"*

> *"The manner in which everything was organised really impressed me. The materials as well as the lecture room were well prepared. The video conferencing also was exciting despite the technical problems we had. Impressed about the discussions and participation of the group as a whole. The presenters were really challenged and that kept the whole group awake. Well done"*

> *"I feel very fortunate to have attended this course and wish to thank the sponsors and presenters for what they have done to promote science communication. This course has enriched my understanding of communication and I hope to promote science communication and the image of the sponsors and presenters where possible."*

While a detailed analysis of all the responses in the pre- and post-course surveys is outside the scope of this report there are a couple of immediately interesting points to note. Only one individual mentioned 'public engagement' or the public's involvement in policy-making anywhere in the pre-course survey whereas the concept was used by five additional students in the post-course responses. Similarly, it appears that many participants moved away from considering science communication as simply sending a message about science towards a more audience focused, 'translation' of concepts that 'bridges the gap' between scientists and the public.[1]

Brazil

In Brazil, where the group was heterogenous (combining practical science communicators with master's and Ph.D. students in education), the students highlighted the usefulness of the course, especially the opportunity to discuss different tools for engaging the general public with science. They also stressed the importance of the course since there are limited opportunities for learning about science communication in Brazil, despite the fact that increasing number of young people are being attracted to the field as a professional activity. They suggested that a future course include videoconferences with other Latin American sites. They also commented on the technical problems that afflicted the course, suggesting in particular that future courses build methods for the students from different sites to stay in contact and interact.[2]

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1 Additional evaluation information about the South African experience is available from the South African coordinator, Marina Joubert.

2 Additional evaluation information about the Brazilian experience was not available during the drafting of this paper, but is available from the Brazilian coordinator, Luisa Massarani.

V. Funding

Development of this course was supported by the U.S. National Science Foundation, with substantial additional support from Cornell University's College of Agriculture & Life Sciences. Additional substantial support was provided in Brazil by Fundação Oswaldo Cruz and the Study Center of the Museu da Vida. Additional substantial support was provided in South Africa by the U.S. Embassy in Pretoria, by the University of Pretoria, by the South African Agency for Science and Technology Advancement (SAASTA), by the South Africa Department of Science and Technology, and by the Scienza Discovery Centre at the University of Pretoria.

Coordinators at all three sites were supported by particular individuals, whom the authors have thanked directly.

VI. Conclusion

We conclude that the course was successful, and that it fills an important gap in developing countries. Similar initiatives are worth pursuing. However, the course required substantial resources for coordination and implementation. Future attempts at such an international course will require dedicated staff time and funding.