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The State of Science Communication Programs at Universities Around the World

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Building on discussions at two workshops held at the recent 10th International Conference on the Public Communication of Science and Technology during June 2008 in Malmö, Sweden, this article proposes specific steps toward achieving a common understanding of the essential elements for academic programs in science communication. About 40 academics, science communication professionals, and students from at least 16 countries participated in this process.

Keywords: *public communication of science and technology; PCST; teaching science communication; curriculum development*

The 10th International Conference on the Public Communication of Science and Technology (PCST-10) was held in June 2008 in Malmö, Sweden. Two sessions were convened to discuss the principles that guide the development of science communication programs at universities. About 40 academics, science communication professionals, and students from 16 countries in Europe, Asia, the Americas, and Australasia discussed the important components of core curricula and shared their experiences.

Authors' Note: The authors kindly acknowledge the help of Will Rifkin, University of New South Wales, Australia, in preparing for the workshops, and we thank all participants in our e-mail discussions, survey, and workshops. Please address correspondence to Dr. Nancy Longnecker, Faculty of Life and Physical Sciences, M011, University of Western Australia, 35 Stirling Hwy., Crawley, WA 6009, Australia; e-mail: Nancy.Longnecker@uwa.edu.au.

Science communication is relatively young as an academic discipline (Bryant, 2001; Enscot Team, 2003; Jasanoff; 1998; Seydel, 2007; Turney, 1994). Both research and teaching are being developed amid discussions of "science communication" as a profession. Dedicated journals such as *Science Communication* and *Public Understanding of Science* facilitate sharing and discussing research findings. Together with an increasing number of published books, this allows construction of a common knowledge base for the new discipline. Our attention is focused here on the teaching in this new discipline.

There is a great deal of diversity in the structure and curricula of science communication programs in universities around the world (Crockett, 1997; Enscot Team, 2003; Kramer & Mulder, 2006; Willems, 2001). Our purpose, then, was to look for commonalities and to determine whether it was possible to describe a general framework for the teaching of science communication. Is there content that should be considered obligatory and included as the core of all degree programs in science communication at their various levels (bachelor's, master's, and doctoral)? And what content ought to be treated as optional or elective?

Survey

In the months leading up to PCST-10, a message on the PCST mailing list elicited responses from 19 universities in 10 countries that gave information about their respective science communication programs. There was diversity in many aspects.

Students

With increasing recognition at universities around the world that education and training in science communication are valuable for *all* science students at both undergraduate and postgraduate level, we received responses from a number of programs, the focus of which is to teach communication skills to science students. These were mostly short, skill-based courses designed for students majoring in science at either undergraduate or postgraduate levels. There also are a number of full degree programs in science communication, almost exclusively at the postgraduate level (i.e., postgraduate diplomas, master's and PhD degrees).

This is the first major distinction that can be drawn between various science communication programs. Those programs intended as a supplement to students continuing in science typically emphasize communication skills required for communicating to fellow scientists (e.g., PowerPoint presentations, preparation of posters, writing journal articles) and dealing with the media (e.g., press releases, radio and television interviews). These programs are tailored to the level (and thus requirements) of the students and also are offered to experienced scientists. Some small programs do, however, touch on most of the issues taught in the full programs on science communication. Degree programs in science communication typically emphasize communication theory and those skills necessary to provide effective translation of science for the public and, as needed, to facilitate the development of public policy with respect to issues involving science through interactive science communication.

Teachers

Some programs are taught under the umbrella of the humanities (schools, divisions, or faculties, depending on each institution's naming convention), some from within media studies or journalism schools or departments (which may be part of the humanities or social sciences, or stand-alone groupings), and others are taught from within the sciences.

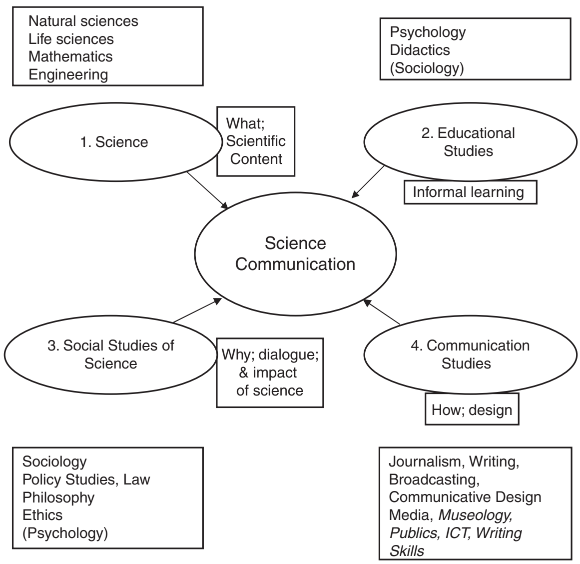
In starting a new academic science communication program, teachers and allies can be found in all four of the cognate areas discussed in the next section (Figure 1; also see Kramer & Mulder, 2006). The administrative home of the program can be in any of the four areas.

While most of the full degree programs represented at the PCST-10 workshop fit comfortably within the hub of the model outlined in Figure 1 and offer programs that prepare students for the broad field of science communication, a few have a particular focus or strength that is predominantly in one or other of the cognate areas (e.g., creative writing at Johns Hopkins University and journalism at the University of Wisconsin).

Cognate Areas

Based on a provisional analysis of the information we received, current science communication programs at universities appear to combine aspects from the four key cognate areas of science, education studies, social studies of science, and communication studies (Figure 1). Science communication is a relatively new discipline and is, by its very nature, interdisciplinary. Each of the areas on which it heavily draws has a much longer history as an academic discipline which confers academic credibility and provides a resource of

Figure 1
Four Areas of Study That Support the Discipline of Science Communication



research and journals on which to build, while science communication is only recently developing into a discipline in its own right. This is of course the same route traversed by these four pillars of science communication; they are mostly interdisciplinary and build on even older disciplines (as indicated in the figure). Full degrees in science communication tend to cover these four supporting disciplines to some extent in their curricula.

There are some general national or regional trends apparent in the development of science communication programs:

- In North America, our preliminary results suggest that science communication is largely run out of humanities or social sciences divisions and is heavily weighted to the social sciences. The focus often is on communication theory and assessing communication efficacy.
- In Australasia, four of the five science communication programs represented at PCST-10 are based in science divisions. The teaching in most of

these programs is weighted to the practice of science communication. In other words, the emphasis is on *how* to communicate science more effectively rather than *why* some forms of communication are more effective than others.

- In the Netherlands, the science communication master's programs have been set up in science faculties. Like the Korean MA program, they were developed in response to government policy imperatives in the early 2000s. The Dutch and Korean programs cover a broad spectrum, combining elements from all four cognate areas as shown in Figure 1 (see, e.g., Kramer & Mulder, 2006).

We tried to itemize the elements taught within individual programs according to their relationship to the four cognate areas identified in Figure 1. We currently are collecting and collating responses from various institutions teaching science communication and will validate the data and check for consistency in the measures. Responses from seven full-degree programs (six master's and one graduate diploma program)[1] are used here to give a preliminary overview of what we are finding to currently constitute the backbone of university-based science communication programs.

Science. Many postgraduate programs in science communication are open only to students who already have a degree in science. In the case of the Dutch master's programs in science communication, having at least a bachelor's in science is a mandatory requirement. On top of that, all Dutch master's programs require students to do an additional research project of one full semester in their original disciplines. The rationale is that the students will then have some sense of what it is to do scientific research and will know more about their own disciplines. In some programs (e.g., Australian National University and University of Western Australia), incoming students also already have at least one degree in science, and research projects within the science communication graduate degrees are in the discipline of science communication.

In other programs, such as Barcelona's Pompeu Fabra University (Coll, Revuelta, & De Semir, 2006) and New Zealand's University of Otago, students differ in background, age, and work experience. Nevertheless, in these programs and in science journalism courses, knowledge of the scientific process is considered important to some degree (see, e.g., Lafollette, 1979) and a vital element in the curriculum. So while only about half the programs included (a) some element of conducting science research in their program and (b) the process of communicating to other scientists (through writing scientific papers and giving oral presentations), nearly all programs identified a requirement that their students were competent at accessing science information through literature reviews and searching databases.

Educational studies. One central tenet of science communication is the ability to explain a scientific issue to a nonscientist. It comes as no surprise, then, that all programs cover this element with students being taught to interpret scientific data and explain it to a target group. About two thirds of programs go into the theories of learning and didactics that underlie successful communication, while just over half the programs spend time dealing with the associated issue of how to alleviate cognitive misconceptions that can affect the ability to communicate effectively.

Within educational studies there appears to be more attention paid to "informal learning," for example, in science centers or museums. This creates a natural bridge with the new discipline of science communication.

Social studies of science (SSS). SSS (or science and technology studies [STS]) forms a basis for reflecting on science—and on science communication as well. Findings from SSS and STS types of programs are prominent in discussions about forms of interactive science communication, the motives for science communication (the "why"), and the impact of science communication on science as well. All programs surveyed for PCST-10 dealt with the discourse on the transition from a "deficit model" approach to a more egalitarian, dialogue-based science communication model.

Though all programs covered this at its most simple and basic level, there was wide divergence when it came to the details. A clear majority covered risk communication and whether science communication can influence behavioral changes in society. But only about half the programs dealt with science policy, funding, and management; scientific controversies; or the ethical, legal, and social aspects of science.

Communication studies. By far the most common elements in the science communication programs we reviewed stem from the broad field of communication studies. Programs cover design issues based on communication theories and the skills needed to apply this theory in communication products.

All programs require students to interpret an issue and communicate it to a target group, with most concentrating on design elements of the products, use of language, and the use of new technologies that aid communication. About two thirds of programs examine the media and how the media works, with a similar proportion of programs engaging in an element of science journalism and/or the application of communication theory. Only about half the programs deal with interactive approaches to communication and persuasive communication (i.e., communication designed to effect a behavioral change). Perhaps somewhat surprising, only about half the programs require students to design some form of evaluation strategy to measure their effectiveness at communicating.

Projects common to nearly all programs are (a) conducting an interview, (b) making a poster, and (c) writing a press release. Other types of projects present in about half the programs are (a) writing a news story, (b) writing a children's story, (c) producing displays for museums and the like, and (d) producing items for radio or television.

Research

One of the general questions we asked ourselves during the PCST-10 sessions was whether research in science communication should be a requirement for graduates in science communication programs. In all six master's programs we included in this overview, students are obliged to do a certain amount of research in science communication. They must be able to write a proposal and perform the research. Five out of six programs specify that their graduates should be able to critically read papers on science communication. They should have an overview of research strategies and methods and be able to report their own research findings clearly. In a next step, we want to further document the research part of the curricula because doing research is one of the core elements of many academic master's programs.

Where to From Here?

During the two sessions at PCST-10, participants discussed where to go from here in terms of elucidating a common framework for the teaching of science communication.

Some of the questions identified as needing to be addressed are the following: Is there a core structure for science communication programs? How should it vary depending on the length of the course? What are the advantages and disadvantages between a theory-guided program and a skills-guided program? What is the relationship between employment or employability and the curriculum? How can someone market a university science communication program? How can someone measure the effectiveness of science communication programs?

A number of steps were identified as being important to bringing some sort of order and appropriate recognition to the discipline of science communication.

Formation of a Register of Science Communication Programs

The idea here is that information about different science communication programs from around the world should be collated in one place. This should include information on the coverage of the various elements identified as being in science communication courses. It would mean a large extension of a current European Union database on science journalism programs (European Commission, 2007) and overviews such as those given on the Web sites of the Da Vinci Instituut (2008) and Intute (2008). Participants proposed locating this register on the PCST Web site.

Recognition of a Core Framework

Tied to the above could be a form of recognition given to those programs that cover the core competencies recognized as constituting the heart of a science communication program. While it could be impractical and needlessly expensive to suggest some form of external auditing of programs, a voluntary commitment from institutions to undertake adhering to the principles of the core framework could be overseen by a society or organization (e.g., the PCST network). If there are important topics that are missing, they may be identified in broader discussions involving professionals and researchers within the PCST network.

Adherence to a framework would give prospective students some confidence as to the makeup and relevance of courses that advertise as conforming (noncompliance would be bound to be reported by students, and, if persistent or serious, the overseeing body would choose to make some notes to that effect on the register).

Establish a Database of Resources for Teaching

Development and sharing of resources was identified as a useful outcome of the workshop. Many participants offered to share materials they have identified or developed. This could include background materials, templates for exercises associated with teaching science communication, and particular case studies. This could build on activities undertaken by Enscot (2003) and ESConet (2008).

Establish a Major Prize for Science Communication

To lift recognition of science communication as a discipline, it was suggested that an annual prize that recognizes extraordinary achievement in the area of science communication should be established. Note that this is different from current prizes that typically recognize achievements by scientists (including communication), as it would be targeted at specialists in science communication.

Many of these actions depend on whether there really is, or could be, a common framework for the teaching of science communication. For that reason, we are continuing to expand our database of science communication programs and analyze the data, which we will summarize for later publication.

The robust and enthusiastic discussions before, during, and after PCST-10, the results of the two sessions at PCST-10, and our preliminary overview presented here suggest that there are core competencies that could—and perhaps should—be common to courses in science communication. Equally, it is apparent from our sessions and surveys that science communication currently is being taught in a great variety of ways, often from different perspectives. While variety may well be "the spice of life," when it comes to gaining academic standing and respect it is essential that a new discipline such as science communication should have a recognizable framework and theoretical basis from which to grow. In our opinion, there is potential for such development, and, assuming it can be formalized, the future for science communication as an academic discipline has never looked healthier.

We invite academic colleagues from science communication programs that were not represented in the workshops at PCST-10 to get in touch to ensure their programs are identified and included in the register and this study. We recommend continued dialogue via the PCST network. Like every discipline, we can benefit from continued dialogue within our international community.

Note

1. Australian National University, Canberra; University of Western Australia, Perth; Hokkaido University, Sapporo, Japan; Sogang University, Seoul, Korea; University of Groningen, Netherlands; Utrecht University, Netherlands; University of Otago, Dunedin, New Zealand.

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