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SCIENCE COMMUNICATION FOR SCIENTISTS: EXPERIENCES FROM AUSTRALIA

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ABSTRACT
The results of evaluations of "Science communication for scientists" workshops conducted by the Centre for the Public Awareness of Science (CPAS) are presented. The workshops have been conducted predominately in Australia and target practising scientists from early career to the most senior researchers.

Their value is considered in an environment in which the need to effectively communicate science with other scientists or non-technical audiences is increasingly important. An outline of the workshops is presented offering a flavour of both workshop content and pedagogical techniques. Evaluations are synthesised and presented alongside anecdotal/informal feedback. The overwhelming majority of participants report an increase in their science communication confidence and skills. It is concluded that such workshops are invaluable to participants, both in providing key science communication skills and raising awareness of their importance.

INDEX TERMS
Science communication for scientists, Conducting science communication workshops, Workshop evaluation, Pedagogy, Australasia and the Pacific

INTRODUCTION

The culture of science as it exists today frequently encourages insular thinking and practice. To gain status in the sciences often means increasing one's level of specialization to the exclusion of general scientific knowledge: depth at the expense of breadth. This creates barriers to communication between what become "specialization silos". People dig deeply into their own silo, but may spend little effort engaging with the silos around them, better yet with the greater society in which these exist. While the culture of science may be guilty of supporting more insular perspectives, there is increasing evidence that it is desirable that this changes.

In Australia and the region, scientists are increasingly expected to communicate regularly and clearly with each other, and with the lay community. Government and Academic scientific institutions can no longer simply rely on PR and marketing. Increasing, scientists themselves are expected to communicate, or at least be prepared and capable to should the need arise.

This push is not unique to our region. Representatives at the UNESCO World Conference on Science in 1999 adopted a *Declaration on science and the use of*

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scientific knowledge. Among other things, the Declaration recommends "including science communication training as part of a scientist's education".

Enhancing scientists' communication skills is comparatively new, and many have never been exposed to even basic communication training. Not surprisingly, scientists can be reluctant, unconfident or inexperienced public communicators. This can misdirect or create antagonism in public debates, especially with high-controversy issues such as cloning. To change the culture, scientists need guidance and training in public communication skills, by no means an unproblematic undertaking.

There is still a legacy of deficit model thinking in the siblinghood of science. This manifests in such comments as "if people just knew the facts, they would appreciate the importance of my work…" . There is also a popular misconception that everyone is a communications expert (Cribb and Hartomo, 2002). After all, don't we all 'communicate' with people everyday?

The challenge increases considering lecturing may be seen as the pinnacle of information sharing techniques among scientists. A lack of familiarity with the need, and the techniques required, to go from didactic communication exchanges to transactional, interactive, and negotiated exchanges exists. Also, effective communication is inherently cross-disciplinary and requires consideration not only of what is to be known, but also ways in which to know (Keen and Stocklmayer, 1999). Accordingly, CPAS has provided science communication workshops for training or practising scientists for more than a decade.

The first major objective of these workshops is to alter scientists' perceptions about their traditional approach to communicating science with lay audiences, as well as each other. The second is to provide skills training to enhance capacity and confidence in communicating science with lay non-scientific audiences and/or specialists in other fields.

THE SCIENCE COMMUNICATION PROCESS

Workshop participants might be Ph.D candidates or senior/experienced research scientists. Commonly, departments and organisations working in sustainability areas (e.g., salinity research) commission these workshops. Participating organisations are predominately Australian, but CPAS has also conducted these workshops in the Pacific and in Thailand.

The core presentation team consists of people with a credible track-record in the culture of science (former practising scientists). These are Sue Stocklmayer, Mike Gore, and Chris Bryant. On occasion, Rod Lamberts has also contributed sessions when certain specialist information is required. Programs for workshops combine a number of approaches including lectures and Q & A sessions, small group interaction, writing exercises (for example, providing a summary suitable for lay audiences of an aspect of their own work), presentations to peers, iterative and cumulative 'homework' revision exercises each day, and active reflection (see figure 1).

Day 1: Introduction to scientific communication

• Why should scientists communicate? An introductory discussion

• Elementary presentation skills. An interactive session during which participants first stand up and talk for one minute.

•Considering your audience. Perspectives on understanding. Session introduces importance of listening *and* speaking,the importance of clear language, cultural considerations and thinking about the audience.

• Writing for an audience and the media. A workshop session.

• Homework. Participants are asked to come with a short written summary of some aspect of their own work. They are now asked to use this is as a basis for preparing a four-minute talk and a short written piece (not more than two to three hundred words) that might be published on the features page of a newspaper. They also practise a short talk on a general topic.

Day 2: Communication strategies

• Talking to other scientists and talking to the public; the image of science. An interactive session that looks at the cultural norms of science, what we know about the public and what the public knows about science.

• More about presentation skills. An interactive session, during which participants present a prepared short talk on a general topic.

• More on writing and 'translating' the science for a general audience. Participants are taken through more aspects of the demands of writing for a newspaper.

• Homework. Participants revise their previous assignments in light of the day's experience.

Day 3: Synthesis

• Written assignment. Final discussion and revision.

• Talking with confidence. Participants present their own science for a general public audience.

• Reflection, evaluation and close.

Figure 1. *A typical workshop program*

Scientists often become frustrated initially with the concept and process of turning technical information into plain language. They may, for example, try to find synonyms for complex and unusual terms rather than providing an explanatory sentence. This has lead to concerns about how difficult their science is, how people simply wouldn't understand, and ultimately to the idea that people should just leave them alone to do their work.

Such sentiments are amenable to overt and active challenge within the parameters of the workshops. For example, participants are tasked with filling in the now famous 'public understanding of science' test (Durant, Evans & Thomas, 1988). It can be eye-opening for participants realising they are, in fact, on a par with the oft-lamented lay public in terms of scientific literacy in disciplines not their own. They are also presented with an array of evidence demonstrating how difficult it can be for even the highly educated to relinquish old misconceptions in the face of strong evidence to the contrary.

These challenges can be confronting for some. Much effort is put into conducting the workshops with good humour, creating an atmosphere of support and encouragement, This means people can reflect on their current practice, and experiment with new skills, with minimal fear of embarrassment.

Modelling and demonstrating skills, such as ‘the ideal presentation’, provide learning opportunities for participants beyond the presentation of theory and facts. For example, Mike Gore demonstrates how he has presented counter-intuitive concepts about rotational mechanics and topology to lay audiences. This shows how even complex phenomena can be presented effectively to inexpert audiences.

Writing skills are also thoroughly addressed. For example, participants are first exposed to an interactive writing session. Issues of language, tone and style are addressed in the context of writing. This not only hones writing skills, it also highlights connections between the written word and earlier speaking techniques. The focus in the writing sessions is on simplicity. Appropriate sentence structure, vocabulary, style, punctuation, as well as use of jargon, colloquialisms and acronyms are all considered and practiced. The initial writing session concludes with in-depth examination of the iterative processes required to turn a piece of scientifically technical writing into a suitable popular piece.

Briefly now to cross-cultural situations, noting that “cross-cultural” does not always mean “cross-ethnic”. In one activity, groups of participants rate, from one to five, a selection of texts according to how ‘scientific’ they are. There is frequently dissent, both within and between groups, especially when subjects like acupuncture are rated. This reveals how difficult it might be to communicate science with general audiences when even a room full of scientists can’t agree how scientific the examples are.

In closing, four significant pedagogical techniques underlying these workshops should be noted; interactivity, modelling, practice and iteration. Participants interact to build a body of best practice science communication skills. They model successful written and spoken science communication techniques, partially reinforced by iterative ‘homework’ assignments using their own scientific work.

EVALUATION

Workshop success has been measured formally and informally. Formal evaluation comprises end of workshop questionnaires (open and closed items). More than 400 scientists have participated in these workshops, with an initial sample 204 out of 217 presented here. Ninety nine percent agreed that program content met their needs and that the mixture of topics and presenters were excellent or good. Workshop relevance was deemed either excellent (41%) or good (59%). It also contributed to their understanding (strongly agree, 34%; agree 60%). The majority felt the skills acquired in the workshop would allow them to improve their communication practice (strongly agree, 49%; agree 50%).

Looking at comments, a PhD student said the workshop was ‘Very timely and relevant in helping to develop material on my research illustrates the urgency that young scientists feel about acquiring the skills for public communication’. One workshops comprising mainly young biologists said they were most surprised that “Simple is good!”, and also by their “ignorance of the importance of science communication!”. Younger scientists are increasingly enthusiastic about these skills.

Presenters have noted a strong influence of the culture of science. When asked to briefly present their own topics, with critique avoiding content (with focus on word flow and audibility, for example), people often present with wit and enthusiasm. In later, longer talks on their science – emphasising content – notable changes in performance occur. Even in the supportive environment, many change their style when science *content* is open for criticism. Worse when being video-taped. Presenters have noted with surprise how dry talks become, even after lively earlier presentations: "…many of the science stories that emerge are fascinating, potentially full of interest. [But] it is clear that there is considerable resistance to making them entertaining. The culture of science…seems to inhibit joy and levity when discussing one's research" (Stocklmayer, Bryant & Gore, in press).

In written and spoken pieces, participants are often surprised by how much needs simplifying. This has to be balanced against the attitude that making their science more comprehensible may trivialise their work or be condescending to lay audiences they are targeting. Initially, the need, indeed the *compulsion*, some feel to explain all the background information before describing their work is still relatively common. It is reasonable that experienced scientists might feel varying degrees of insecurity in presenting their work stripped of supporting information. The culture of science directly instils this. Too little information in the scientific realm and they risk their professional reputation. Too much information in a more general communication, and they risk being seen as out of touch with society. The latter may be an acceptable occupational hazard, the former, potentially career threatening.

Turning specifically to writing skills, many realise that they have changed (even improved!) their ability to communicate science to broader audiences in writing. They also recognise that they still have room to improve, making humourous, self-critiquing comments such as "Me written skills is much betterer!".

Before leaving the results, a note on informal feedback. Core presenters comment that they often hear from participants about their success in interviews or their improved written pieces for lay audiences. Former participants may ask for advice or feedback on science communication material from presenters long after their workshop. This is encouraging as it not only suggests that the skills are useful and being used, but also that the CPAS team were seen as sufficiently relevant, credible and approachable to be adding value to these people's careers.

DISCUSSION

The results indicate that these CPAS workshops have been successful. Unsolicited exchanges with former workshop participants show this success extends beyond short-term enthusiasm. Skills acquired are relevant and presented in ways suitable to participants: our methods suit our audience.

We know, too, that the best way to improve communication skills is to use them. This is modelled and impressed upon participants, who are encouraged to stay in touch after the workshop. By doing this, informal networks develop that provide some of the support people found in the workshop. This is facilitated by emphasising 'critique' does not mean 'criticism', and that neither need be a personal attack.

Obviously there also are challenges. Regardless of the long-term enthusiasm workshop participants may feel, returning to a work environment lacking support for our philosophy or techniques means at best some skills will be lost, at worst despondency may ensue. This is one of the great difficulties of workplace training – maintaining enthusiasm and support for new skills after return to work. The contact and advice offered by presenters after the formal relationship has ended is one way CPAS counters this: a testament particularly to the dedication of the core team.

It is also acknowledged that participants will be differentially influenced by their workshop experiences. Some will leave satisfied and confident in their newly honed science communication skills, others less so. If, at the least, a workshop raises participants' awareness that changes in practice are needed when communicating with lay audiences, then headway has been made. Not all scientists are going to become excellent communicators, but all can make improvements.

CONCLUSION

It is clear to us that these workshops 'work', predominately because of participant feedback on content and structure. Participants respond well to the 'safe' environment. They also see great value in the interactive and participatory models applied over the three days. The opportunity to practice, and to iteratively hone both written and oral material not only aids in skills transfer, it also helps increase the scientists' respect for those in the communication professions. CPAS' services are also increasingly in demand in the region.

The 'science communication for scientists' workshops run by the Centre for the Public Awareness of Science provide a practical contribution to the increasingly common ethos of multilateral knowledge sharing that is vital in the 21st century. Ideally, we would like to see the day come when such skills are considered core knowledge in any science discipline. To be of greatest value, the practice of science communication must move from a grudgingly acknowledged science adjunct, to a desirable key skill in any and all science-related organisations. These workshops offer an example of just one way people in the Asia-pacific region are working towards that goal.

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