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Policies and practices in supporting scientists' public communication through training

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Scientists are increasingly expected to engage in public communication, though they frequently report that they feel inadequately prepared for such activity. The necessary training for such activity has barely been discussed in the science communication literature. Drawing on country reports from the Monitoring Policy and Research Activities on Science in Society in Europe (MASIS) report, this paper reviews initiatives across Europe to support scientists' public communication. It examines these within a framework that distinguishes between training oriented to dissemination or dialogue, and to capacity-building of scientists or professionalisation of science communicators. It traces the uneven spread and diverse character of such supports and identifies the four principal groups of policy actors who play distinct roles and, in the case of higher education institutions, sometimes internally contradictory roles. The paper draws on the authors' own experiences to underline the value of communication training that is oriented to dialogue and stimulates reflexivity.

Keywords: communication; dialogue; government policies; university programmes; training courses; professional education.

1. Introduction

Governments, research institutes, universities, research funders, professional societies and many more actors in science policy agree: scientists need to talk more with the public. Whether this talking is proposed in the name of dissemination, public engagement, science in dialogue or scientific culture, it is widely seen as crucial to the development of science and to its position in society. Proposals to promote public awareness or public engagement have become a standard element of national science policies and scientists are seen as having an important, through not exclusive, role in such programmes.

Over the last decade in particular, the demands from institutions and from policy-makers on scientists to perform in public have intensified and become more formal. As a major trans-national research funder, the European Commission has driven scientists' public communication through the dissemination clauses in many of its research contracts and through its direct funding of 'science in society' projects over the past decade.

Several countries in Western Europe have written commitments to science awareness or popularisation into national policy and law. For example, legislation introduced in 2003 governing universities in Denmark, requires them to 'disseminate knowledge of academic methods and results' and 'exchange knowledge and competencies with society and encourage [their] employees to take part in the public debate'. In France, universities are now required to establish programmes to promote 'scientific and technical culture'.

Reflecting increased competition in higher education, universities across Europe have employed publicity professionals to help raise their institutions' profiles. These public relations (PR) teams, in turn, look to their universities' scientists to offer potential media stories from their research and to become more adept at media interviews and public talks. Professional societies, special interest groups, businesses and foundations with a particular orientation to science are also active in this field through 'science and society' or similar initiatives.

Public communication of science and an associated professionalisation of science communication are being inscribed into the norms and operations of the institutions where scientists work. In significant part, this is done through units such as PR or education and outreach offices attached to universities and research institutes. But in policy circles, and perhaps in society at large, it is still very widely expected that more and more scientists will give more and more effort to explaining, discussing and justifying the work they do.

Citizens in EU member states want to hear developments in science communicated by scientists rather than journalists (European Commission 2007). Asked whether they preferred scientific information to be presented by journalists or scientists, 52% of survey respondents across the 27 member states said that they preferred scientists and 20% chose journalists, though this average conceals a wide disparity between a 73% preference for scientists in Greece and a 24% preference in Austria.

A survey of Danish scientists' attitudes to the legislative requirements on universities to communicate with the public (Nielsen et al. 2007) found that many more respondents (43%) assigned to scientists (i.e. themselves) the main responsibility for meeting those requirements than assigned this responsibility to communications departments (31%) or faculty administrators (25%). Paradoxically, however, when respondents were asked how they would allocate possible budget resources to science communication, they favoured university communications departments over communication training for scientists and, by a larger margin, over communication training for PhD students.

Over half of UK scientists (MORI and Wellcome Trust 2000) indicated that they engaged in some form of public communication and 75% felt 'equipped' to communicate the facts of their research but a large majority (84%) had received no training in communicating with the general public and an even larger majority (90%) had no training in dealing with the media. The survey respondents sought incentives from research funders and institutions to encourage researchers to spend more time on public communication.

The Royal Society in the UK found that 73% of scientists surveyed had no media, communications or public engagement training (Royal Society 2006). In interviews, scientists looked to research funders (such as the co-sponsors of the study, Research Councils UK and the Wellcome Trust) to provide appropriate training in public communication, considering current provision to be inaccessible and needing to be taken to researchers in their workplaces.

According to Turney (2006):

> . . . there is no substitute for having real scientists involved in public engagement. Professionals are mainly helpful as mediators or facilitators, but they cannot deliver authentic access to real scientific practice, or the latest expert findings. We need to train a lot of scientists to do a little, and devise incentives for researchers to dip in and out of public engagement, as their careers permit.

More recently, a UK expert group reported that it:

> . . . was not in favour of compelling scientists to engage with the media but we did feel that a requirement for all scientists to undergo some media training was not unreasonable if only to teach them some basic facts about good communications skills. (Science and Media Expert Group 2010)

Mindful of the debate that lies behind such observations we review initiatives at institutional, sectoral, national and supra-national (European) levels to promote public communication among scientists, focusing on the practical supports, specifically training, for scientists' public communication and how these supports orient such communication. We also look at the policy choices being made between measures that incentivise and support professional scientists directly in their public communication and measures that support the training of science communicators for careers in intermediary positions between researchers and publics. These strategies can co-exist in any given national or institutional context, but the two approaches do represent distinct choices. A debate among subject experts in Germany (Gerber 2011) pointed to the risks of a sharper division of labour between scientists and science communicators, specifically in shielding scientists from needing to develop further their understanding of the public.[1] Already 15 years earlier the French physicist and science commentator Jean Marc Lévy-Leblond (1996) had expressed concern that the increased presence of communication intermediaries would absolve scientists and scientific institutions from their social responsibility to engage with the public.

We identify the two strategies as *capacity-building* (of scientists in their public communication) and *professionalisation* (of science communicators). Within each of these, but particularly in the first, there are also clear lines of difference between an approach based on imparting techniques to improve communication functionally and one oriented to exploring how various points of view can be represented in public communication of science. The first of these approaches gives priority to *dissemination* of scientific information, the second to fostering *dialogue* on scientific issues between various social actors.

The final report of the EC-funded Messenger project reflected these options in noting that opinions differed among those consulted on the nature of the training that scientists need: some limited it to media skills that are relatively straightforward to impart and others said it involved 'an awareness of social as well as epistemological considerations' (SIRC and ASCOR 2006a). In this context the distinction drawn between dissemination and dialogue may seem simplistic but it serves the present purpose. We have discussed these and other models of communication

as applied in science communication in greater depth elsewhere, with particular reference to the deficit-model variant of dissemination and its critique (Miller 2001; Trench 2008).

Our review of the activities of the main actors in the field in supporting scientists' public communication draws largely on the country reports produced for the MASIS project[2] and that project's methodology is explained elsewhere in this special issue of *Science and Public Policy*. For this review we referred to sections 4.1, 4.2, 4.3 and 4.4 of these reports concerning science communication. We found something more than passing mentions of supports provided for science communication, including specific references to training of scientists' for public engagement, in 12 of the 38 country reports. (We excluded the many references to training provided in mainly central European countries under the British Council's Famelab initiative, an unusual case of imported science communication support.)

In several cases, the country reports did not mention such training where we, through direct experience, know it exists but the number of such references may be taken as indicating the low policy priority given to this aspect of science in society. We followed leads from the MASIS country reports to primary source materials and drew on our own experience and information to expand these searches. Our own backgrounds may have contributed to an Anglophone bias in the collection of examples but much of the international commentary on these matters also shows a similar tendency, reflecting the influence beyond the UK of policy initiatives such as the Royal Society report (Royal Society 1985) and the House of Lords report (House of Lords Select Committee on Science and Technology 2000).

We cannot claim that our review is a survey of a representative sample of projects and programmes in the field and we doubt that such a sample could be constituted. The paper presents indicative evidence of patterns and trends in support for scientists' public communication in four domains of policy and practice. The paper is proposed as a contribution to the very sparse, and almost all quite recent, literature on science communication training (e.g. ENSCOT Team 2003; Miller et al. 2009).

The absence of reference to training when science communication is under discussion is sometimes striking. Bauer and Jensen (2011) mention scientists' feeling of lacking appropriate skills as a disincentive to public engagement in their introduction to a special issue of *Public Understanding of Science* on the mobilisation of scientists for public engagement. But none of the ten other papers in that journal issue explored further the provision of training.

Among those who have considered this issue, Poliakoff and Webb (2007) wrote:

> A scientist's perception of his or her own ability to participate in a public engagement activity has a significant effect on his or her intention to participate. This finding speaks to the importance of the public communication and media training programs offered by research councils and universities.

Researchers in science communication are themselves personally convinced of the important role of communication. A survey of authors of papers in five publications in science, health and risk communication found that a majority was active in training scientists, medical personnel or engineers in public communication and believed strongly that scientists benefit from training in media skills and in direct communication with the public. (Besley and Tanner 2011)

In an analysis of the findings of US and UK surveys of scientists' views of, and motivations for, their public engagement practices Besley and Nisbet (2011) also wrote of the need for further research in the field that includes:

> ... studies aimed at assessing individual scientists over time, perhaps in conjunction with sustained leadership or training initiatives such as Stanford University's Leopold Institute or the ESConet communication trainings. Our hope is that scientists will continue to participate in such programs and that funding can be found to support their development and evaluation.

We elaborate below, as participants in that initiative, on the ESConet programme.

2. National governments

Attitudes to science education and science careers and public perceptions of science and scientists have become common concerns of government policies across many countries as building knowledge economies has become a guiding principle of public policy. As a paradigmatic case among late-developing economies, Ireland set out policy on science, technology and innovation (Government of Ireland 1996) stating the need for greater 'public comfort' with science. Under a government-funded science awareness programme, Discover Science and Engineering (DSE), many scientists and engineers have engaged in public activities but the incentives come mainly as exhortation from their own institutions, guidance on good practice has been minimal and no training to support and improve this activity has been offered as part of the national programme. In early 2012, responsibility for DSE passed to the principal research funder, Science Foundation Ireland (SFI). At about the same time, SFI held its first communication training courses for selected recipients of its research grants.

In many other countries the principal responsibility for promoting public communication of science and by scientists has also been devolved to state agencies and higher education institutions. However, the following examples illustrate considerable variation in the level and character of European governments' intervention in shaping the context for science communication.

In the UK, the parliament's upper house produced a landmark report on science and society (House of Lords Select Committee on Science and Technology 2000) that has been widely cited in discussions of science communication strategies across the world, particularly in reference to its view of the need to promote social dialogue on science. In follow-up discussions the UK Government's Office for Science and Technology defined its role as:

> . . . working with [the research] funders to ensure that scientists are both encouraged to engage with the public and are rewarded for doing so, and that they are suitably trained to do so. (Office for Science and Technology 2003)

Government recognised the training need but referred provision to the research councils.

A Science and Media Expert Group (2010) reporting to the UK Department of Business Innovation and Skills recommended that new training courses for scientists be provided by the Science Media Centre and additional media fellowships for scientists be provided under the British Science Association's fellowship programme. Both the Science Media Centre and the British Science Association are non-governmental bodies.

Governments intervening more directly include the German government which incentivises public communication by scientists through award schemes that, at least indirectly, set standards of best practice in the field. The Spanish, Danish, Norwegian and Belgian governments support research dissemination through web portals and the federal Belgian government also provides guidance to researchers on public communication. The regional government of Flanders (Dutch-speaking) has a Science Communication Action Plan that incorporates support for a science centre, a science week and a science festival as well as for science communication 'expertise cells' in higher education institutions and a science news web portal.

In the neighbouring Netherlands, science communication has been institutionalised through legislation, formal policy statements and the establishment of state-funded agencies for the promotion and communication of science and technology (Sanden 2008).

The Danish University Act of 2003 formally states that:

> The university shall collaborate with society and contribute to the development of international collaboration . . . As a central knowledge-based body and cultural repository, the university shall exchange knowledge and competencies with society and encourage its employees to take part in the public debate.

It should be noted that the legislative requirement is for university researchers to engage in both dissemination and dialogue but the balance between these strategies is considered moot, as we shall see later (Mejlgaard 2009; Mejlgaard et al. 2011).

The French law of 2007 on the Freedoms and Responsibilities of Universities recognises 'dissemination of scientific and technical information and culture' as one of the six missions of higher education and many universities have established units to undertake and support this work. A report by French senators (Blandin and Renar 2003) called on universities and research institutes to assign some of their personnel to public communication and to recognise this work in their career progression. However, the report made no reference to any need to equip researchers better for public communication through training or support from science communication professionals.

In summary, we can say that European governments' support for scientists' public communication, where it exists, is mainly oriented to capacity-building of scientists for communication in dissemination mode, though practical support is generally devolved to others.

3. Higher education institutions

Over the past two decades universities in several continents have adopted science communication as a subject for education and research and as part of institutional practice. There are perhaps 50 degree programmes, mostly at Masters' level and mostly in Europe, providing qualifications in science communication and producing candidates for the diversifying opportunities in science centres, popular science publications and websites, university and research institute information services and other outlets. The associated growth of PhD studies in science communication (Sanden and Trench 2010) represents a stabilisation of this university subject and also indicates that it is seen as more than a topic for professional training.

The degree programmes in science communication are in many cases sustained by the efforts of individual enthusiasts or small groups, generally working in the margins between longer-established disciplines and departments (Trench 2012). Some programmes have closed or struggled to survive in circumstances of retrenchment in higher education. Few universities have committed strongly and strategically to science communication as a new (inter-)discipline. However, the pattern of expansion and retraction is uneven: while some programmes stop or are temporarily suspended, new ones start. Masters' programmes in science communication began in 2011 at Eotvos Lorand University in Budapest, Hungary, and at Universidade Nova, in Lisbon, Portugal. Reflecting the diversity of origins and institutional settings of these programmes, the Budapest Masters is located in the science faculty and has strands in museums and journalism while the Lisbon Masters is based in the social sciences faculty of the Universidade Nova, though delivered in partnership with the Institute of Chemical and Biological Technology. The institutional setting of these

programmes—in humanities/social sciences or natural sciences contexts—tends to correspond with a greater emphasis, respectively, on dialogue or dissemination.

Australian National University's Masters in Science Communication was the first of its kind when it started in 1987 in association with the Shell-sponsored Questacon travelling science circus. The primary objective was to produce 'explainers' to take science to the scattered Australian population, thus professionalisation of disseminators. Some years later, Turney (1994) could distinguish science communication programmes focused on communications skills from those providing 'skills with added theory' or presenting 'the big picture'. The last of these referred to the then-emerging postgraduate programmes denominated as science communication qualifications.

Fifteen years later the number and range of 'big picture' programmes was reflected in a special edition of the *Journal of Science Communication* which presented various views of the scope of science communication as a subject for study and investigation. Semir (2009) placed 'the process of public transmission and diffusion of scientific knowledge' at the centre of concerns while Greco (2009) referred to the programmes' focus as 'a complex dynamic system that functions on many intercommunicating levels'.

The competing policy drivers in universities are reflected in the appointments, notably in the UK, of high-profile professors of public understanding of science or science and society apparently made mostly with the prestige of the university in mind and:

> ...[embodying] a split within universities over the perceived role of academics with respect to public science. (Mellor et al. 2008)

Some of these top-level appointees have neither researched nor lectured on their nominated subject but may have produced works of popular science (Miller 2008). The PR needs of universities and the competition for students, staff and funds are also the main drivers of supports for researchers' public communication through targeted training. But some of this effort is oriented to civic engagement and to public dialogue.

A primary orientation to dissemination appears to underlie, for example, the short courses for university researchers in the Valencia region of Spain on integrating public communication into their professional practice. The Jülich Research Centre in Germany provides media training courses for researchers on the basis that:

> ...taking account of the competition for state research funds and the need to secure support from society, only those can survive in the 'media society' that make their achievements publicly known.[3]

However, the inter-university group Agorà Scienza in the Piedmont region of Italy aims to promote awareness among postgraduate students and young researchers of the social implications of science and the importance of communication. The network provides training courses that aim to provide 'a multi-faceted perspective on current understanding of science, where communication can make a difference'.[4]

Communication training of researchers oriented to dialogue is also provided by many French universities, including, for example, the University of Lyon, whose Science and Society team trains academic staff and doctoral students in various aspects of public communication. One doctoral student noted that having young visitors necessitates:

> ...taking a step back and explaining to oneself one's motivations, one's research, one's aims, confronting points of view and engaging in subjects for discussion that go much further than everyday experience.[5]

We shall see further evidence of such reflexivity promoted through training and engagement in social dialogue on science.

Universities in Denmark train their science students in presentation and dissemination and offer lectures by academics for schools. Other strategies are largely mediated through the growing PR departments of universities, prompting critical comment in the MASIS country report (Mejlgaard et al. 2011):

> The field of science communication in Denmark is increasingly focused on transmission of scientific knowledge from science to society, in order to enhance citizen skills and understanding, and less concerned with constructive technology assessment based on citizen participation and dialogue between scientists, policy-makers and citizens.

The report's lead author had earlier noted that a distinctly Danish, and socially inclusive, approach to public communication of science was weakening (Mejlgaard 2009): there were signs that:

> ...the principle of institutionalised public participation in S&T decision-making is being challenged by a re-emerging commitment to science dissemination.

This shift from dialogue to dissemination represents a reversal of the trend most often observed elsewhere.

In summary, we can say that European higher education institutions active in this field support scientists' public communication through capacity-building activities oriented mainly to dissemination and in a smaller number of cases through professionalisation programmes oriented in various degrees to dissemination and dialogue.

4. Research councils and other actors

Research councils and other research funders in many European countries impose contractual requirements on recipients of funds to undertake dissemination or

dialogue activities. Some have a formal policy commitment to promoting research communication in order, in the words of the Swedish Research Council:

> . . . to ensure that the results of research reach the areas in society where they can be useful, for example within education, healthcare and in trade and industry.[6]

Some research councils also incentivise these activities through award schemes and support them through training programmes. A study of five UK Research Councils (Pearson 2001) noted that all of the councils provided training directly or engaged others to do this or gave financial support to scientists taking training courses.

In Switzerland the National Science Foundation:

> . . . encourages public debate on scientific findings and issues, promotes the sharing of knowledge between scientists and interested groups and supports open access for research results.[7]

In Luxembourg the National Research Fund runs workshops for researchers to help them present their projects intelligibly to children, teenagers and to a lay public and in Germany research funders encourage scientists' participation in a programme of lectures for children at universities through awards schemes: the major Communicator Award is worth €50,000.

The German foundations, Robert Bosch Stiftung and Klaus Tschira Stiftung, provide funds for research and also support science communication initiatives through training programmes and award schemes. Similarly, the British-based research foundation, the Wellcome Trust, gives grants to projects on communicating with young people, to science festivals and to science-and-art interactions. The Wellcome Trust runs training workshops, including workshops in narrative skills for various categories of researchers, including doctoral and postdoctoral researchers. The Trust has been an important promoter of dialogue-oriented science communication and awards fellowships to scientists, science communicators, artists or others active in public engagement to help them develop their 'skills and practice in encouraging the public to examine, explore and debate the big scientific challenges that society faces'.[8]

The British Science Association supports scientists' participation in public dialogue through its annual 'festival', a multi-disciplinary scientific conference strongly oriented to making current research accessible to broad audiences, and through its Perspectives competition for young researchers which has caused researchers to reflect that:

> . . . it helped me see my research topic viewed from a different perspective. (Hillier 2006)

It also provides support through its media fellowship scheme in which scientists immerse themselves in the media world for a month, working under the guidance of a journalist in a newspaper or broadcast organisation. Former fellows have testified that the experience was stimulating and eye-opening.[9]

Among other charities active in this field, the British Council stands out for its very strong international profile. MASIS reports for several central and eastern European countries cited the British Council as a primary player in science communication—almost a proxy policy agency—in those countries, organising science cafés and staging Famelab competitions in which mainly young researchers present their work in three minutes.

In summary, we can say that state-funded research councils actively support scientists' public communication, mainly through capacity-building courses in dissemination-oriented training. Foundations and charities supporting research and science communication provide similar support but also help develop scientists' capacity for public dialogue.

5. The European Commission

The European Commission has been a major promoter of public communication by scientists and other forms of science communication through policy statements, conferences, publications, contracts for organisation of events and funding for research projects and 'co-ordination actions' under successive Framework Programmes for Research. The European Commission also undertakes (Eurobarometer) surveys on attitudes to science and technology which are very important to the Commission, to national governments and to other actors in shaping public communication strategies.

The EU's Framework 5 Programme (2000–4) included a project-funding stream entitled 'Raising Public Awareness of Science and Technology' (European Commission 2003) and the associated Science and Society Action Plan (European Commission 2001) proposed to 'promote scientific and education culture', 'bring science policies closer to citizens' and 'put responsible science at the heart of policy making'. The 38-point action plan represented a commitment to engagement and dialogue between the scientific research community and the public at large.

An EU benchmark study of activities in 'the promotion of research, technology and development culture and the public understanding of science' identified national 'climates' for science communication and noted that few countries were doing very much to train their scientific research community to communicate with their fellow citizens or to engage with their concerns (Miller et al. 2002).

Similar points were made by two contemporaneous EU-funded projects. The Optimising the Public Understanding of Science (OPUS) project produced a handbook to help those involved in science communication overcome some of the prejudices of the deficit-model approach to science communication (Felt 2003).

The European Network of Science Communication Teachers (ENSCOT) developed teaching materials for science communication programmes around the dialogue and debate themes then coming to the fore in science and society discussions (ENSCOT Team 2003).

ENSCOT also produced materials for short science communication workshops that were developed further in a later project, the European Science Communication network (ESConet). These training modules aimed to cover the needs of most researchers for the basic dissemination skills of writing for the mass media, taking part in radio interviews, as well as more dialogue-oriented web writing (Miller et al. 2009). They also covered skills such as risk communication and making presentations to policy-makers, stressing the need for researchers to develop the ability to listen actively to fellow citizens to facilitate social dialogue.

The EC-funded Messenger project produced guidelines for scientists that took them through procedures and practices in media communication, particularly when dealing with questions of risk. They also advised scientists to seek further support and training:

> Attend workshops, seminars etc. that enable scientists and journalists to meet and discuss relevant issues. Get to know how journalists work and the constraints that they face. (SIRC and ASCOR 2006b)

A similar emphasis on understanding the constraints of media production is found in a European Commission 'survival kit' for scientists engaging in public communication (Carrada 2006). This document reflected the dialogical turn in science communication, advising scientists that:

> . . . the communication of science is no longer simple dissemination, but rather a process in which different players produce knowledge, messages, attitudes and new practices accepted by all.

The European Commission can be seen to play a significant role in supporting scientists' public communication both directly and indirectly. Its direct activities tend to be dissemination-oriented but its indirect activities have included several significant projects developing models for capacity-building in social dialogue on science.

6. Concluding remarks

Our review of the roles of four main groups of actors in supporting scientists' public communication suggest that:

- *Governments* tend to emphasise dissemination activities and to support (mostly indirectly) capacity-building of scientists for such activities.
- *Higher education institutions* tend to operate on two weakly (or not all) connected planes, supporting scientists' public communication through training mainly for dissemination and—in selected cases—providing programmes that contribute to the professionalisation of science communication and that are oriented to dialogue at least as much as to dissemination.
- *Research councils* increasingly expect grant recipients to communicate with various publics about their work and they provide mainly dissemination-oriented training, directly or indirectly, that supports such efforts,[10] though charities and foundations who fund research also provide training for dialogue.
- *The European Commission* requires funded projects to undertake 'dissemination' (the Commission's own preferred term) activities. While not providing guidance or training directly, the Commission has supported projects that have insisted on training as indispensable and that have developed models of communication and of communication training oriented to social dialogue.

Overall, the emphasis across these several sectors is stronger on dissemination than on dialogue and significantly stronger on capacity-building than on professionalisation. But we offer from our own direct experience some observations on the demand for and impacts of communication short-course training and professionalisation programmes that are explicitly oriented to public dialogue on scientific issues.

In 2009–10, the ESConet team[11] delivered 20 'basic' and 20 'advanced' three-day science communication workshops. Nearly 300 researchers, representing all but two of the EU's member states and mainly in early-to-mid career, took part, many of them taking both 'levels'. The modules demanded considerable effort from the researcher trainees but there was a considerable waiting list at the end of the project, indicating the feasibility and desirability of widening and extending such training oriented to social dialogue. Of 281 responses to an evaluation form completed by course participants, all but three completely agreed or rather agreed with the statement, 'I have learned new useful things'.

ESConet also undertook a more detailed evaluation of the workshops, surveying trainees before and after the training sessions (Magnusson et al., forthcoming). In particular, the project team wanted to compare the levels of confidence amongst participants following training with those prior to the workshops. A somewhat complicated picture emerged: after training, respondents reported that they felt that a range of science communication activities were more difficult than they had anticipated but they felt somewhat more confident that they could carry them out. Perhaps like driving a car, science communication looks easy until you have to do it, but then having lessons really helps.

ESConet's findings chime with those of a cross-country (and cross-continental) survey which also reported a small but significant correlation between communication training and confidence among researchers in communicating with the public (Peters et al. 2008).

ESConet also found that confidence among those who took both the introductory workshops and those that introduced them to public dialogue and debate were higher than among those who had only been trained for media writing and interviews. In the post-workshop surveys, nine out of ten trainees reported that they had been involved in some science communication activity during the following months, with an average of more than five activities per respondent.

Participants' evaluation of short courses based on ESConet models have also indicated satisfaction with being challenged to think about scientific research in wider social contexts. Comments from participants in courses for food science researchers delivered in Dublin in 2009 and 2012 included statements such as:

> The course was a bit more intense than I had expected but extremely informative.
>
> I really found it stimulating and informative to hear about the topic of communication from another viewpoint.
>
> Since the course I have viewed media coverage in a different light.
>
> I hadn't realised before the course that risk communication is such a delicate area and represents such a responsibility for scientists.[12]

Such expressions of newly acquired reflexivity are more pronounced in reference to the experience of longer Masters programmes. Former students of the Masters in Science Communication at Dublin City University responded to a survey with comments that included:

> The MSc opened my mind to other disciplines, broadening my world view. It made me more reflective and critical.
>
> [The MSc] caused me to think about science from a different perspective and in a wider context, which has impacted on my personal view of the world and on my current career as a scientist.[13]

On the basis of the above review and the experiences reflected in these trainee and student comments we close by offering these recommendations:

- Training of scientists in public communication should be provided early and in the mainstream of their education.
- Early-career scientists should be encouraged to follow the interest in public communication that many of them show.
- Scientists who engage in public communication around their science should receive formal recognition, even if only symbolic, for these activities.
- Communication training for scientists should be aimed at more than competence in story-telling but also at lessons in citizenship.
- Academic education in science communication needs to maintain broad and critical perspectives and not be restricted to vocational training.

Notes

1. In the German adoption and adaptation of English-language acronyms, PUS (public understanding of science) and SUP (scientists' understanding of the public) have come to be seen as interdependent, reflecting an increasing emphasis on dialogue over dissemination.
2. Brian Trench was MASIS national correspondent and author of the Ireland country report.
3. <http://www.fz-juelich.de/inm/inm-8/EN/Leistungen/Dienstleistungen/Medientraining/medientraining_node.html> accessed 6 November 2012.
4. <www.agorascienza.it/en/training> accessed 6 November 2012.
5. From Activity Report 2010 of Science and Society Service, University of Lyon, posted at <http://www.universite-lyon.fr/medias/fichier/rapport-d-activite-2010-du-service-science-et-societe-de-l-universite-de-lyon_1323426692746.pdf> accessed 6 November 2012 (authors' translation).
6. <http://www.vr.se/inenglish/aboutus/remit.4.44482f6612355bb5ee780001601.html> accessed 6 November 2012.
7. Guidelines for Public Communications by the Swiss National Science Foundation posted at <http://www.snf.ch/SiteCollectionDocuments/allg_lignes_directrices_comm_e.pdf> accessed 6 November 2012.
8. <http://www.wellcome.ac.uk/Funding/Public-engagement/Funding-schemes/Engagement-Fellowships/index.htm> accessed 6 November 2012.
9. Testimonials and detailed reports on personal experiences are available at <http://www.britishscienceassociation.org/web/ScienceinSociety/MediaFellowships/Personal+experiences.htm> accessed 28 February 2012.
10. A recent study (Palmer and Schibeci 2012) of research funding bodies mainly outside Europe concluded that there is:

    > . . .currently a preference, with a few exceptions, for approaches which 'educate the public about science' (Type 2 science communication).

    In their four-part typology, Type 2 is closest to what we term 'dissemination'.
11. ENSCOT and ESConet were directed by Steven Miller, one of the present co-authors. Brian Trench contributed to the development of materials and delivery of workshops under these projects.
12. Data contained in final report to European Commission of ESConet Trainers project, 2011 (unpublished).
13. Data from course reports available to Brian Trench as course leader (unpublished).

14. Data from graduate survey undertaken by Brian Trench and published at <http://www4.dcu.ie/communications/resources/pdf/Results_of_survey_of%20graduates_of_MSc_in_Science_Communication.pdf> accessed 6 November 2012.

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