



An introduction to communicating science

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Abstract

It is becoming increasingly recognised that students in Higher Education must acquire the skills necessary for professional and personal development, as well as for academic progress. The media have recently focused on the issue of declining public interest in the sciences and the lack of accurate reporting of science. We have developed a new programme, which endeavours to address both issues involving a three day intensive course covering writing, TV and radio. In addition to the targeted activities of learning the skills of science communication, the programme encourages partnerships, and exploits the resources and expertise available from various institutions. The undertaking of this type of programme is not limited to the acquisition of time slots in a studio such as Bush House. Most university campuses are now home to their own recording studios and even have television facilities. However, the programme requires only a video camera and audio recording equipment. The success of this science communication module and of two others run by MOAC and CBC (Team Development and Decision-making and Leadership) has encouraged us to develop a complete postgraduate certificate in transferable skills. We anticipate the certificate will be a valuable vehicle for consolidating and enhancing the training discussed in this article.

The General Skills Problem

It is becoming increasingly recognised that students in Higher Education must acquire the skills necessary for professional and personal development as well as for academic progress. This recognition has arisen from concerns regarding the lack of preparation graduates have for embarking upon a career outside of their particular course of study. Employers, both within and outside academia, now demand that Higher Education Institutions place more emphasis on training in transferable (or generic) skills and interpersonal development. The report of Sir Gareth Roberts' Review for HM Treasury particularly points out that "[...] the skills profiles of many jobs within business have altered, requiring greater breadth of skills and aptitudes."¹ Higher Education Institutions are currently attempting to confront this concern across the board with the development of transferable skills and vocational programmes.

At postgraduate level, the demand for high quality PhD graduates in the sciences has also moved beyond scholarship alone towards a more comprehensive standard of education: employers are looking for balanced skills and aptitudes in a broad educational spectrum rather than focusing on specific and narrow scientific achievement. PhD graduates increasingly require a wide range of transferable skills in order to be successful in the employment market. The Joint Skills Statement² published by the UK Research Councils, the Arts and Humanities Research Board and PhD funding charities outlined a framework for skills development in Higher Education. These included, alongside research skills development: personal effectiveness, communication skills, networking and team-working.

The Communication Problem

The media have recently focused on the related problems of declining public interest in the sciences and the lack of accurate reporting of scientific information to the public. It seems evident that in the absence of accurate and clear reporting, the public interest in scientific issues will be reduced, and this loss of interest will result in a reduced incentive on the part of the media to report on such matters. If scientists are not trained to report to non-scientists clearly and accurately on scientific issues, it will be difficult to break this cycle of decline. This lack of training in media-related issues has meant that scientists are unprepared to discuss their research and its implications. As the media have become more pervasive, complex and fragmented, scientists are at greater risk than ever before of losing the trust of their audiences, unless they engage with the media.

The BBC pointed out in an online report that experts had made a range of recommendations for improving public understanding of scientific issues. These included: (i) media agencies employing more science graduates, and (ii) encouraging science graduates to take part in media training.³ In addition, the Wellcome Trust has been highly vocal on this subject. They commissioned a survey regarding scientists' perception of science communication. The results of the survey revealed that in the opinion of scientists "... the things that would most help to improve communications between the general public and scientists were encouragement and incentives from institutions and funders (for scientists) to spend more time on science communication, (to have) training in dealing with the media, and (to have) more financial support."⁴ A summary of their research also pointed out that "[...] fewer than one in five [scientists] have had training to deal with the media and/or to communicate with the public."⁵ This deficit in communication between scientists and the general public is thus, among other things, attributable to a lack of incentive and resources in higher education, leading to a lack of confidence and awareness in graduating students.

However, professional scientists are now being encouraged to heal this breach through courses in communication, such as those currently run by the BBSRC⁶ and the Royal Society's Media Programme.⁷ Since the early 1990s, the agenda has shifted from public understanding of science to public engagement with science. Public engagement is now a focus of scientific organisations and higher education institutions and research councils, and scientists at all levels are being encouraged to take responsibility for communicating their research.

The onus on graduate training programmes is on training the scientists of the future. It is, therefore, the responsibility of the higher education institutions to offer their students the support, training and opportunities to develop their communication skills and their ability to encourage and respond to public and media interest in their work. These skills have now become a priority for professional development and the new generation of scientists must be able to engage more efficiently with an increasingly demanding audience. However, there is not a long history of tailored training programmes for young scientists. The question is how to develop such programmes so they integrate into existing postgraduate training and to ensure their relevance to students whatever their planned career path.

Skills Training at Warwick and Imperial

The Doctoral Training Centres (DTCs) are sponsored by the Engineering and Physical Sciences Research Council (EPSRC) which is responsible for the establishment of the Life Sciences Interface (LSI) Programme, in which the emphasis is very much on an innovative and comprehensive approach to postgraduate training. The EPSRC is focused upon building an effective research community out of the many developing LSI DTCs. The Doctoral Training Centres of the University of Warwick and Imperial College are multidisciplinary scientific training programmes at the interface between Chemistry, Biology, Physics, Mathematics and Computer Science. However, as Doctoral Training Centres, their responsibility to students' development does not end at challenging their scientific minds, but requires them to encourage and expand their ability to face unfamiliar situations with confidence and alacrity. Their very nature as programmes spanning multiple

disciplines lends itself to the potential acquisition of manifold skills both within academic scientific practice and beyond.

The MOAC (Molecular Organisation and Assembly in Cells) Doctoral Training Centre at Warwick and the Imperial College CBC (Chemical Biology Centre) have taken a leading role within this community in developing transferable skills training for students within this pioneering scheme. In doing this they have had certain advantages, primarily those of being new (and hence being able to establish new ground rules), of being provided with funding earmarked for skills training and having staff who, from the outset, have been committed to the delivery of such training. Moreover, Warwick and Imperial have reputations such that they are able to attract outstanding students from the UK and around the rest of the world. These students are not only extremely able but are committed to launching their careers using whatever help and training their DTC can provide. They are intrinsically, therefore, an ideal cohort with which to develop a creative and effective skills training programme which may be used as a model by other centres. As small centres MOAC and CBC can take advantage of being able to build personal relationships with each and every one of their students and to track their progress closely throughout their time with them.

The outcome is that a transferable skills training programme has been implemented which owes nothing to the 'two hours a week in term-time' model, but integrates the acquisition of the different skills into the daily research lives of the students. It is during their routine research activities that students achieve both academic discipline and specialist knowledge in their chosen areas, and also personal development, enhanced communication skills, networking capabilities and team-working practice: these transferable skills are integral to their daily experiences.

This combination of excellent students and an active skills programme integrated into their research activities provides an unparalleled opportunity to address the problem of presenting scientific issues to the public. As part of their transferable skills programme we set up a science communication training project which involves all of our second year PhD students. This project introduces them to a greater awareness of current topical issues surrounding science for the public and in the media, in order that they may disseminate their knowledge and relate their practice to aware and active listeners. A criterion for the project was that it should relate to their lives as research students and should develop their skills in presenting topical and controversial issues to the public. It was structured as a three day venture held in London in January 2006, run by Gareth Mitchell, a lecturer at Imperial College's Science Communication Group, and presenter of the BBC World Service technology programme 'Digital Planet'. The programme is set out in Table 1. It will be run again in July 2007 for the following year's intake of students.

The CBC/MOAC Event

The event began with an introduction to science journalism. In an interactive class session, the students encountered and discussed a range of science issues from that week's news. This included pieces from newspapers, television, and radio.

Next the group turned its attention to communicating science through television in Imperial College's own TV studio. Students had the opportunity to conduct an 'as live' television production in the style of the BBC's 'Question Time', involving one presenter and three guests. With the help of technical support experts from the Media Services team at Imperial College, individual students took up the positions of director, camera operators and vision mixers. Stem Cell Research was the dominant topic for the students as they had been required to prepare this in advance of the event. The opportunity to



Figure 1: Studio

conduct a simulated television debate engaged the students with dialogue relating to the ethical implications of current scientific research and the topical issue of the peer review process. The experience was enriched by giving students the opportunity to explore a mode of communicating science seldom seen on television. In so doing, they gained interesting insights into the nature of science controversy and began to explore and critique the manner in which science is reported in the broadcast media.

The second stage of the course involved an introduction to the medium of radio. In their novel guise as radio reporters, the students were instructed in the use of professional microphone and audio recording technology in order to conduct interviews and gather sound bites for their radio programmes. The first group involved themselves in current student politics at Imperial, with the issue of the implementation of a mandatory display of ID cards, which had provoked a strong reaction among students. They also managed to secure an interview with Professor Alain Gringarten, the Chairman of Petroleum Engineering and Director of the Centre for Petroleum Studies at Imperial College. The second group were slightly more ambitious in their endeavours and waited outside of the Houses of Parliament in the hope of catching an MP. However, despite their valiant efforts, the parliamentarians eluded them – no doubt a difficulty arising from the fact that it happened to be a Friday afternoon.

That evening, the two groups made their way to Bush House, the headquarters of the BBC World Service. They worked in studio S6 – a studio fully equipped for radio news and drama – and after editing their collected materials, they conducted a simulated 'live' broadcast under the expert supervision of the Studio Manager Simon Morecroft. The emphasis was particularly on public interest pieces, with the first group's

broadcast discussion entitled "Is Britain about ready for an oil change?" tackling the current topic of the impending peak-production of fossil fuels. This was followed by a short debate on the matter of ID cards at Imperial College and the implications should this become a national phenomenon, entitled "Is Big Brother watching you?" The production finished with a light-hearted piece analysing the ethical implications of cloning Schrodinger's cat, a humorous experiment in quantum mechanics: "If a cat is cloned in a box and no one is around to see it, does it still meow?" with telephone guest speaker, physicist Alexis Rutherford.

The second group began with "The hot topic of global warming" followed by a piece on "The explosive issue of nuclear power". Also topical that day was the issue of the bird flu, discussed in the context of the potential impact of the virus, should it reach the UK. In a gesture particularly relevant to the role and purpose of the transferable skills programme itself, the third item was a discussion about the problem of lower student interest in the sciences at high school level leading on to university. MOAC's own Professor and Centre Director, Alison Rodger, was on hand to discuss this worrying endemic deficit in students participating in and enjoying academic science. The topic is of concern to educators in scientific disciplines, and a major reason for programmes such as this one, focused upon bringing science back into the public eye.

At the end of the event MOAC and CBC provided feedback to the whole group of students who undertook the activity. The groups were given praise and/or criticism regarding their own group performances on the day and in their follow-up work.

Evaluation of the event

Meetings of the staff involved in the venture took place after the course was completed in order to evaluate the efficacy of the module.

a) Staff evaluation

Although running for the first time the module was felt to be a success. It was devised as an innovative approach to familiarising the students with the necessity of public interest in the sciences, as well as introducing them to the skills needed to cope with and indeed seek media exposure for their work. It was something that the students had never confronted before, and offered them training in something totally removed from the laboratory, whilst still relevant to their discipline. The science communication programme opened up avenues that many had perhaps never considered, and some students have since expressed their interest in careers in scientific journalism. Others who remain focused upon a laboratory-based career gained invaluable experience and knowledge.

At the outset it seemed rather ambitious to fit so much into a short course, especially as for most of the students the broadcast environment was an unfamiliar one. However, the course organisers and the participants were pleasantly surprised at how well the doctoral students engaged with such a challenge. Communication skills have been enhanced by not only revealing the opportunities which are available to the students but also by improving their confidence in their own ability to discuss and share their work with others. Teamwork and cooperative skills have been tried and tested in an unfamiliar environment and students have applied their already strong problem-solving skills to something other than

their own scientific projects. The proof of the module's effectiveness is given by the activities of the students since the course. Table 2 summarises the participants' public engagement activities in the 12 months following the module. One student's work has been discussed on BBC Radio Five Live, the national news and sport network. Others have been into school class rooms, worked on general public science displays of various kinds and, perhaps most importantly, all have talked with new confidence and effectiveness to their friends, families and members of the general public they have met in non-professional contexts. Some of them have created opportunities; e.g. by issuing a press release on a published paper, which led to an article in the Coventry evening Telegraph.



Figure 2: Editing

b) Student comments

Each student felt that, even if they were not interested in pursuing a career in scientific journalism, they would be more positive about being interviewed about their work or getting involved in publicity relating to their disciplines. Their post-course activities (summarised above and detailed in Table 2) show that this is not simply post-course enthusiasm.

In addition, their own suggestions from the evaluation forms were discussed, and we indicated which suggestions we intended to adopt, so they could see that their input was taken seriously. Some students suggested that there should perhaps have been more on written journalism, while others felt that they would have benefited from an extra tutor on the science communication training course who could have provided more criticism about their productions, more exercises and a brief written summary of what they had learnt during the day. We are implementing these changes for 2007.

Changes to the Event

Having now run this course once it is felt a number of improvements could be made. A structured follow-up to the course would be of great benefit in order to consolidate students' learning and monitor their progress, and would perhaps reveal opportunities which might otherwise be overlooked. In practice, not all students exercised their new skills, so a formal follow-up process would be valuable. Keeping track of the developing opinions of attendees who completed the programme may also prove useful in order to gauge to what extent they have found their additional learning useful. A review six months after the course from each student who attended, detailing in what ways they have used their new skills or knowledge has been implemented in order to assess the long term benefits of the course for their academic and professional development. Our policy has been for no formal assessment to be required for our transferable skills programmes, but a formative assessment or feedback would help us to improve what we provide.

As noted above, the students felt that communication in the sciences should be extended to include a course in scientific writing for journal publication. In a recent report on transferable skills in postgraduate education, Margaret Cargill pointed out that "[...] professional written skills form an important subset which contributes to many other skills categories. Skilled writing is an essential requisite for both academia and the workplace so intrinsic motivation for developing the required skills is high[...]"⁸ It also contributes greatly to their professional development, as well as offering the students extra means by which to disseminate their research and practice to a wider cohort of people. Large universities, such as Warwick and Imperial, benefit from a huge variety of academic resources. We have therefore taken the request for writing training very seriously and have established a term-long scientific writing module at Warwick, where newly re-established relationships between the sciences and the humanities has allowed us to employ the expertise of staff in the English department, who also have science backgrounds, to provide training in journalistic and academic writing. This is not only beneficial for the students but also helps create a cooperative balance between and among disciplines with the potential to gain from each others' expertise.

Longer-term Outcomes

The course is a hands-on experience which allows students to see various sides of public access and media engagement. This fulfils not only a requirement of the students to relate their acquired knowledge to a wider society but also a national need to bring science back into the public interest. Waning scientific awareness is something that many academic departments would like to see reversed. If our students become aware of the need for knowledge exchange, and how to fulfil it, they become equipped to not only enhance their own skills but build very necessary bridges between academia, the laboratory and the outside world. Scientists need to re-establish communication links with non-scientists and young people in order for the discipline to continue growing and provide inspiration for the potential research workers of the future.

Students must be aware of the growing need for comprehensive achievement and to be prepared to take on the responsibility of becoming the highly skilled academics

and researchers of the future in a highly demanding environment. It is not only the responsibility of the Higher Education Institution to train these students but also for they themselves to take control of their own learning. Courses like this help them to become aware of the value of the training they undertake and to be involved in the implementation and review process. The Doctoral Training Centres are dedicated to improving their training facilities in line with student demand as well as suggestions from Research Councils. Our practice is reviewed on an annual basis to ensure that the programmes designed for the students are meeting their shifting requirements. In addition the students are heavily involved in the evaluation processes and are invited to contribute to discussions regarding how best to improve their own training and personal development.

In addition the programme encourages partnerships, and exploits the resources and expertise available from various institutions. Networks such as these are essential for opening up further possibilities for enhancement.

Future Developments

We believe that other institutions and disciplines can gain valuable insight from our teaching experience and the ventures we have undertaken. In particular it seems self-evident that transferable skills are best integrated into the student's primary research activities. Moreover the need to disseminate information is not limited to the sciences, and the power and influence of the media need to be understood and exploited by all disciplines to provide maximum benefit. This programme can be adapted to impart the relevant skills and learning in almost any academic discipline or professional training. Offering intelligent students the means and the opportunity to learn something more about the avenues open to them can only broaden their horizons and enhance their outlook for the future. This is not specific to the media only, staff and students alike can benefit from the central achievement of improving communication and confidence in their skills.

The undertaking of this type of programme is of course not limited to the acquisition of time slots in a studio such as Bush House. Most university campuses are now home to their own recording studios or campus radio station; some may even have television facilities. But the underlying issue of the programme can just as easily be tackled with a video camera and audio recording equipment. On-campus facilities should give students a chance to complete live recordings with their newly acquired skills, which will enhance the satisfaction achieved from the undertaking. Such programmes inspire students to seek outside interest in their work and to develop

a relationship between their personal interests and a wider community of people. Their own campus is an ideal place to start learning how to present their knowledge to a wider audience. It generates a greater awareness and a broader understanding of their horizons and thus of what they have to offer. Without these innovations we cannot expect to produce graduates of tomorrow ready to face a world in which the demand for expert knowledge and the exchange of up to the minute information is becoming a universal phenomenon.

We believe it will also be beneficial to share experiences with other centres conducting similar ventures, and also invite others to discussion regarding setting up their own courses in communication.

The success of this science communication module and of two others run by MOAC and CBC (namely Team Development for PhD year 2 and Decision-making and Leadership for PhD year 3) has encouraged us to develop a complete certificate in transferable skills which will be compulsory for Warwick DTC students in the first instance. The certificate will be taken over the three years of a student's PhD and is structured as 6 modules worth 10 CATs (or 5 ECTs) each. These are Key Skills 1, 2 and 3, each of which gathers together a range of skills we increasingly demand of our students (such as oral presentations, posters, financial management, writing for different audiences), as well as the focused residential suite

of MOAC/CBC courses of the type described above, but with a more structured follow-up and assessment to ensure mastery of the skills. The postgraduate certificate will commence in October 2007 and we anticipate it will be a valuable vehicle for consolidating and enhancing the training discussed in this article.

This programme can be adapted to impart the relevant skills and learning in almost any academic discipline or professional training

Table 1: Programme for first Science Communication Course run by Gareth Mitchell at Imperial College and BBC Bush House January 2006.

CBC / MOAC Introduction to Science Communication Module	
January 12 – 14, 06 Imperial College and BBC Radio, London	
Tutor: Gareth Mitchell, Science Communication Group, Imperial College	
Thursday January 12	Friday January 13
0945 Gather in room S204, 2 nd floor, Imperial College Library	0945 Gather in room S204, 2 nd floor, Imperial College Library
1000 Welcome and introduction to science communication	1000 Review previous day's TV exercise and draw conclusions about television as a medium for communicating science controversy
Short exercise on where science news stories come from	Introduction to science radio (with audio examples)
Introduction to science journalism	1115 Coffee break
1115 Coffee break	1130 Discussion of evening's radio exercise
1130 Introduction to <i>Question Time</i> television exercise	Preliminary production meeting
Students already allocated to on-screen / technical roles	1300 Lunch
Preparation and planning for afternoon's recording	1400 Preparations for evening's radio exercise continue
1300 Lunch	1530 Coffee served (work continues)
1400 Gather in Imperial College Television studio	1545 Final production meeting
Group A rehearse and record	1715 Transfer to BBC Bush House
1530 Group B rehearse and record	1800 Group A rehearse and record radio programme
1700 Session Ends	1930 Group B rehearse and record radio programme
Saturday January 14	2100 Session Ends
0945 Gather in room S204, 2 nd floor, Imperial College Library	Social dinner to follow
1000 Playback and review of radio programmes	
Conclusions and farewells	
1300 Course ends	

Table 2: Selected student Science Communication Activities undertaken by participants after the January 2006 course.

2 students took part in a day introducing nanotechnology to the general public, predominantly to school children of GSCE and A-Level as well as some members of the general public. http://www2.warwick.ac.uk/newsandevents/pressreleases/NE1000000213210/
One student will take part in Showcase Science 2007 www.showcasescience.org and http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/E033474/1 running a stall on bio/nanotechnology
2 students were involved with 25 students from London International Youth Science forum (many winners of national competitions) visited to view equipment http://www.liysf.org.uk/images/pics/Brochure_2006.pdf
MOAC newsletter has been created by students
Talking to/entertaining friends and family etc (one student even made some of them sit through a Powerpoint presentation in a cafe)
One student's research has been mentioned on national radio: Five live, Anita Anand.
One student will give a biology lesson for sixth formers in a Solihull Grammar school in 2007
A number of students have talked with primary school age children and doing experiments with them
One student involved in 'Science Ambassador' which meant visiting 2 schools and talking about the importance of science
A number of students have visited secondary schools to talk about their science

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