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Evolving Science Communication: learn, adapt, collaborate

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bettertogether

Introduction

In March 2009 the Science Communication Unit (SCU) at the University of the West of England, Bristol (UWE) hosted a symposium to investigate key issues around transferability and sustainability in science communication and public engagement. The symposium was designed for professionals in the field, specifically aiming to provide a platform for discussion between experts in both the practitioner and academic communities.

The symposium emerged following a major UK-wide project funded by the Wellcome Trust (via an Engaging Science Society Award) entitled Meet the Gene Machine. This project was led by the SCU, working with eight Science & Discovery Centres around the UK to stimulate discussion and debate with over 10,000 young adults on issues around genetic testing. Alongside this over 400 teachers took part in training on incorporating discussion of scientific issues in the classroom. The funding for the project has now ended, however Meet the Gene Machine continues to be delivered in the majority of participating Science & DIscovery Centres, and has also been taken up by new partners in other locations. Meet the Gene Machine has demonstrated that successful science communication activities can be transferable, collaborative and sustainable. The purpose of the Evolving Science Communication Symposium was to investigate these issues on a broader scale.

The following report documents the variety of sessions held at the symposium. Each invited speaker has provided a short summary of their contribution; a brief overview of the discussion that followed is also included.

The editors would like to thank all speakers and delegates who attended the symposium. They would also like to thank the runners Ann Grand, Daniel Keogh, Julianna Photopoulos and Margarida Sardo who offered organisational assistance across the two days. The support of Tom Anthony, Public Engagement Advisor at the Wellcome Trust, and funding from the Wellcome Trust is also gratefully acknowledged.

Karen Bultitude, Helen Featherstone and **Clare Wilkinson**

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Contents

Attendees

Catherine Aldridge - Director, Catalyst Learning and Communication Ltd.

Tom Anthony - Public Engagement Advisor, Wellcome Trust

Andrea Bandelli - VU University

Emm Barnes - Science Outreach Officer, Royal Holloway, University of London

Philippa Bayley - Academic Liaison Officer, Centre for Public Engagement, University of Bristol

Teresa Belcher - Director, Science Communications Ltd

Derek Bell - Head of Education, Wellcome Trust

Isabelle Boscaro-Clarke - Head of Communications, Diamond Light Source

Sarah Bucknall - Public Relations Officer, Diamond Light Source

Martin Bull - Head of Communications, ISIS Pulsed Neutron and Muon Source, Science and Technology Facilities Council

Karen Bultitude - Senior Lecturer, Science Communication Unit, University of the West of England

Dariel Burdass - Education Manager, Society for General Microbiology

Frank Burnet - Frank Burnet: Science Communication Consulting

Sue Cavell - Head of Research and Evaluation, Techniquest

Lucy Chappell - Research Communications Manager, University of Reading

Paul Cox - Head of Science and Learning, National Marine Aquarium

Savita Custead - Director, Bristol Natural History Consortium

Luis Filipe de Oliveira Barbeiro - PhD student, King´s College London

Jennifer DeWitt - Research Associate, King's College London

Justin Dillon - Senior Lecturer, King's College London

Sophie Duncan - Deputy Director, National Coordinating Centre for Public Engagement

Nigel Eady - Science in Society Officer, British Science Association

Helen Featherstone - Research Fellow, Science Communication Unit, University of the West of England

Penny Fidler - Director, ASDC

Ben Gammon - Ben Gammon Consulting

Laura Grant - Principal Consultant, Laura Grant Associates

Shamim Hartevelt - Didactics Specialist, European Space Agency

Karin Hermansson - Research Director, Vetenskap & Allmänhet, VA

Roland Jackson - Chief Executive, British Science Association

Colin Johnson - Vice-President, British Science Association

Diana Kaiser - Education and Outreach, BDI (Biomedical Diagnostics Institute)

Lorraine Kenny - Education and Outreach Manager, Thinktank

Maggie Leggett - Head, Centre for Public Engagement, University of Bristol

Andy Lloyd - Special Projects Manager, Centre for Life

Dom McDonald - Head of Public Engagement, Science Oxford

Rebeca Medrano Arnaez - Formal Learning Manager, At-Bristol

Rosalind Mist - SCORE, Royal Society

Kat Nilsson - Contemporary Science Manager, Science Museum, London

Cristina Olivotto - Educational Project Officer, Human Spaceflight Education Office, European Space Agency (ESA)

Leslie Paterson - Head of Public Engagement, Royal Academy of Engineering

Gillian Rendle - Research Councils UK

Jan Riise - Göteborg Center for Public Learning and Understanding of Science

Alison Rivett - South West Regional Officer, Institute of Physics

Wendy Sadler - Director, science made simple

David Shakespeare - Science Education Consultant, Square 2 Learning Ltd.

Lindsey Shaw Greening - Science Communicator, Science Connect, Milton Keynes Science Festival

Dianne Stilwell - Science and Education Communications Consultant

Wolfgang Streitenberger - Advisor to the Director General, European Commission - DG INFSO

Alice Taylor-Gee - Science in Society Manager, British Science Association

Maria Tennant - Science Communication Officer, British Heart Foundation

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Juliet Upton - Consultant, STEM Directories

Kathy Velander - Senior Lecturer, School of Life Sciences, Edinburgh Napier University

Louise Webb - Head of Skills Development, ASDC

Kenny Webster - Informal Learning Manager, Thinktank

Clare Wilkinson - Senior Lecturer, Science Communication Unit, University of the West of England

List of acronyms

ACME – Advisory Committee on Mathematics Education

ASDC – The Association for Science & Discovery Centres (formerly Ecsite-UK)

BBC – British Broadcasting Corporation

CPD – Continuing Professional Development

DCSF – Department for Children, Schools and Families

E&E – Engagement and Enrichment

ECSITE – European Network of Science Centres and Museums

EPSRC – Engineering and Physical Sciences Research Council

ETB – Engineering and Technology Board

EUSCEA – European Science Events Association

ESRC – Economic and Social Research Council

GCSE – General Certificate in Secondary Education

GLO – Generic Learning Outcomes

HE/HEI – Higher Education/Institution

HEFCE – Higher Education Funding Council for England

IOP – Institute of Physics

MLA – Museums, Libraries and Archives

NCCPE – National Coordinating Centre for Public Engagement

NESTA – National Endowment for Science Technology and the Arts

NSEW – National Science and Engineering Week

PENCIL – Permanent European Resource Centre for Informal Learning

PEST – Public Engagement with Science and Technology

PUS – Public Understanding of Science

QCA – Qualifications and Curriculum Authority

RCUK – Research Councils UK

SEA – Science Enrichment Activity (see also STEM Ambassadors)

SLC – Science Learning Centre

STEM – Science Technology Engineering and Maths

STEM Ambassadors – formerly known as Science and Engineering Ambassadors (SEAs)

STEMNET - Science Technology Engineering and Maths Network

STFC – Science and Technology Facilities Council

SCORE – Science Community Representing Education

Keynote address

Andrea Bandelli

Andrea Bandelli is a specialist in informal learning and science communication, and is currently director of the European Project 'DECIDE' - an international collaborative of science centers and museums to foster public participation in science and technology policy issues. In the last 10 years he has worked in different roles with several science centers, universities and public administration organisations in many European countries, the USA, South Africa and Brazil. His current academic field of research is how public consultations and dialogue processes inform the governance of science museums.

Transferability and Sustainability

The concepts of transferability and sustainability, when applied to science engagement activities, offer a number of stimuli for discussion.

I want to briefly mention two issues related to the concept of transferability: knowledge transfer and research translation.

Knowledge transfer refers to how knowledge crosses from one domain to another; but for us it is important to identify who are the people (and the institutional roles) instrumental for transferring knowledge. It requires also identifying the 'brokers', those who act on the fringe of networks.

Research translation requires us to think about the ethics of science engagement. Speaking about HIV and AIDS at the second African Science Communication conference, Anthony MbeWu, director of the South African Medical Research Council said that 'scientists are not activists', they cannot apply pressure for a specific use of research results in policy. Maybe science communicators are activists, and it is certainly imperative to address the issue of ethical neutrality of science engagement (see for example http://scienceincommunity.wordpress.com/2008/12/04/is-engagement-ethically-neutral/).

How activities, resources and ideas spread, replicate and change, is a fundamental aspect of sustainability. Of particular interest for this symposium is the concept of 'contagiousness'.

Here there are at least two issues of relevance:

- Individualization
- Giving up control

With the increased use of social media we are witnessing the 'rise of the individual' (see 'Here comes everybody', by Clay Shirky), when people can organize without the need for an organization. These new ways to organize are possible because of the increased access to communication technologies. The 'rise of the individual' challenges our usual way of thinking, because we usually associate people with organizations, but increasingly it is not anymore so.

When we look at online activity on social media, a power law distribution is the norm. The most active people are often broadcasters, in the middle we find loose conversations and brokers, and

the long tail is made of many tight conversations within small groups. The consequence is that certain metrics do not mean much anymore: measures like 'average user', or 'target groups' for example. We should therefore rethink our concept of audience.

Giving up control means sharing the authority of what we do. From a project perspective, it means becoming familiar with concepts like: turning planning into coordination; open source resource sharing; a de-institutionalized approach. Projects like Decide and FUND (www.playdecide.org) are initial experiments in this direction, undertaken by ECSITE - the European network of science centers and museums.

Finally, I would like to mention the results of an exploratory action by UWE and ECSITE to investigate the concepts presented above and to understand what instruments enable transferability and sustainability in the case of (EU-funded) projects for science engagement. The key concepts that emerged from that study are:

- Dynamic networks. It is necessary to accommodate dynamic partnerships and networks. We see that this concept is rather well established in the case of high level research projects, but for smaller scale projects it is usually an exception rather than the rule.
- The presence and the role of the brokers. Who acts at the fringe?
- Structural involvement. Engagement activities should not be an 'add on' but an integral process for the parties involved.
- Autonomous spreading. The capacity for an activity or a process to become an independent module that can easily adapt to a different setting.

In conclusion, three challenges lie ahead for discussion in the next two days:

- Raise the meaningfulness of what we do and strengthen our (social) responsibility;
- Acknowledge the political role that science engagement plays;
- Learn to recognize failure. We need new measures of success and impact, especially those based on collaboration.

Discussion

Following Andrea Bandelli's keynote address the discussion focussed on two key areas. These were the value of failure and its contribution to learning and the role of science communicators as neutral facilitators or activists.

Delegates suggested that often there was a tendency to publish success, which could lead to mistakes in activities being repeated. A variety of reasons were suggested for this, including that it can be difficult to admit or publish failures, particularly when it may impact on future funding. There was a suggestion that the notion of having an acceptable rate of failure should be embraced. That learning from inevitable mistakes can be as valuable, if not more so, than hearing about only the success stories.

There was much discussion as to whether science communicators should be, or at least attempt to be, neutral. Some felt they had to try to be, or were commissioned to take neutral stance. Whilst there was also recognition that science itself is not value free. It was suggested that some science communication initiatives are unashamedly pro-science or have the objective of changing behaviour, it was also highlighted that being neutral is in itself a value statement.

At the outset of the symposium it was clear that delegates were working in a variety of organisations, with different funders, publics and stakeholders. Differing agendas drew these issues to the fore and set the scene for some interesting discussion, deliberation and debate in later sessions.

Evolution: exploring public engagement as an evolution of or addition to public understanding of science

This session provided speakers with a chance to explore the 'bigger picture' of science communication. Speakers were invited to unpick current thinking on the relationships between public understanding of science, science communication, and public engagement with science and technology.

Contributors: Roland Jackson, British Science Association, UK
Derek Bell, Wellcome Trust, UK
Chair: Karen Bultitude, Science Communication Unit at UWE, Bristol

Science and the Public

Roland Jackson, British Science Association, UK

Roland Jackson took up the post of Chief Executive of the British Science Association (formerly known as the British Association for the Advancement of Science) in 2002. He was educated at Oxford University, obtaining a degree in biochemistry in 1976, a doctorate in molecular immunology in 1979 and a postgraduate certificate in education in 1980. He taught science in secondary schools in Newmarket and Bristol for nine years, ultimately as Head of Science at Backwell School, Bristol. From 1989 to 1993 he was Education Adviser for ICI. He joined the Science Museum, London, in 1993 initially as Head of Education, and was appointed acting Head of Museum from 2001-2002.

There are many purposes for communicating with the public about science and technology. This communication is carried out through activities described as 'science communication', 'science education', 'public understanding of science', 'public engagement with science' or 'public dialogue'. But these terms hide assumptions that are often, and legitimately, different.

Broadly speaking, there are three motivations for what we might call science communication, or public education and engagement in science, though they can overlap.

First; because it's simply the right thing to do in our society. It is concerned with empowering citizens to understand the implications of science and technology and help shape their decisions about choices, enriching democratic representation.

Second; to achieve a particular outcome, such as promoting the benefits of particular innovations (e.g. by public bodies or by industry), increasing public confidence in the Government's use and management of science, or ensuring the country has a sufficient supply of scientists, engineers and science teachers.

Third; and more challenging to policy-makers, reaching more democratically-grounded and potentially better policy decisions though deliberately incorporating diverse social perspectives, values and knowledge.

For each of our activities we need to be clear and open about the primary motivation. The British Science Association is working towards a shared vision of a society in which people are able to access science, engage with it and feel a sense of ownership about its direction. But what are the barriers to achieving that vision?

Partly it's the nature of science itself. At the root of many of our problems is a clear tension between science as a body of knowledge and practice owned and controlled by an expert community, and science as a wholly shared social enterprise in a democratic society. To maintain its authority science needs to be set apart from the general public, but to maintain its legitimacy and trust it needs to be publicly accessible and reflect public values. That is a real tension that is played out almost daily in the UK.

We have seen much of the post-Bodmer approach to the public understanding of science characterised as assuming a deficit of knowledge by the public, and much of the post-House of Lords approach similarly characterised as assuming a deficit of trust, both to be addressed by science communication. Nevertheless, things are changing, but they need to continue to change both with respect to the culture of science and to the culture of politics and the governance of science. I shall leave out from this discussion the broader question of public culture.

Scientific culture

The recent survey of the attitudes of scientists towards public engagement, commissioned by the Royal Society in 2006, showed that scientists view the purpose of this activity primarily in terms of informing the public. That is an important role for scientists, and one which many carry out with commitment and skill. Indeed the public themselves recognise scientists as a prime and trusted source of information about science. However, it is only half the picture. The public also demand that scientists 'listen more to what ordinary people think'. This requires a reflexivity and indeed, at times, humility amongst the scientific community that is not widespread. As with their involvement in the more didactic forms of science communication, there are many scientists who demonstrate leadership in this respect, and yet involvement in this wider debate and discussion is still not seen as a fundamental part of being a scientist.

Political culture

Public trust in the governance of science, in regulation, and the policy-making process through consultation is critical for science's ultimate licence to operate. Here there have been substantial positive moves, with increasing numbers of open meetings of, for example, Research Councils and regulatory bodies, and minutes being published on the web. It is through consultation processes, and the way in which the Government, regulatory and advisory bodies are seen to respond to those, that long-term trust can be established. Certainly the established formal processes for Government consultations set a firm framework and perhaps there will always be some public cynicism about Government motives and practice. To counteract this, I believe it is important for Government to be clearer about when it is communicating and when it is consulting, and within what parameters. A consultation which appears, whether rightly or wrongly, to be carried out after a decision has already been taken, does much to create distrust in science and its governance, regardless of what scientists do.

In our evidence to the current House of Commons IUSS (Innovation, Universities, Science & Skills) Committee on 'Putting science and engineering at the heart of policy' we offered two substantive options for better use of public engagement in consultations, which we believe would be likely to lead both to more widespread public engagement and information, and to demonstrate more clearly public input to the policy process:

1. The deliberate and active use of significant policy consultations as opportunities for mass public education about the science and the associated issues.
2. The collecting of public views and ideas from much wider and more diverse sources than those of traditional stakeholder or structured intense deliberative processes.

Removing barriers to culture change

Culture change takes time but we should recognise what has already been achieved, which includes:

- Increasing access to information about science (e.g. through the media and internet).
- Increasing access to opportunities to engage directly with scientists (through the programmes of many science-based organisations, and initiatives such as National Science and Engineering Week, science festivals, science centres and the activities of university departments and scientific institutes).
- Signals from key funding organisations (e.g. Research Councils, The Wellcome Trust) that public engagement work is important.
- Networks and programmes supporting science education such as the Science Learning Centres and STEMNET.
- The UK Resource Centre and its championing of aspects of diversity.
- The Beacons for Public Engagement as means of encouraging culture change in the higher education sector.
- The Sciencewise Expert Resource Centre with its emphasis on the culture of policy-makers.

Interestingly, these are primarily enabling and catalytic systems rather than top-down mechanisms.

All these developments, and more, create a positive platform for further evolution and we now need to embed the thinking behind these activities. I leave you with three questions:

- Which of these current systems and networks work well?
- Which could be improved and how?
- What gaps are not being addressed?

Competition Or Co-Existence: evolving relationships between formal and informal education

Derek Bell, Wellcome Trust, UK

Derek took over as Head of Education at The Wellcome Trust in January 2009 after six and a half years as Chief Executive of The Association for Science Education. He has a wide range of interests in teaching and learning science and experience in teacher education.

It is not surprising to find a conference with a theme of evolution being run during a year in which the 200th Anniversary of Darwin's birth and 150 years since the publication of On the origin of species, are being celebrated. It is perhaps more surprising that the conference is not focussed specifically on the biological concept. However, applying the concept to the communication of science provides an interesting metaphor.

In considering ways in which the communication of science has developed to go beyond the science community and academia reflects a changing environment in which a new species emerged: 'public understanding of science'. The organism has adapted as time has gone on to become what is now referred to as science communication. However there are other species in the ecosystem with which science communication either competes or co-exists. One such species is 'formal science education' that all young people must receive from the ages of 5 to 16 as part of the National Curriculum in England, Wales and Northern Ireland. In Scotland and other developed countries, science, whilst not a statutory requirement, is considered a major element in the education of young people.

For years these two 'species' were largely separate but increasingly they have interacted more and more directly. The changes in attitudes towards science and its importance as part of our culture and as a driver of a knowledge based economy, however, have increasingly brought pressures for the two species – science communication and science education – to develop a productive co-existence.

Much progress has been made but there is still a good deal to be done. Young people spend less than ten per cent of their time in school studying science and there is much more science accessible through other sources. The challenge is to find ways in which the energies and resources that go into improving the two areas of activity can be harnessed to maximum effect. Importantly it should be stressed that they are distinct 'species' but I would hope that their relationship would evolve to become increasingly more and more symbiotic.

For example the contribution of The Wellcome Trust to Darwin 200 has been significant and is endeavouring to generate not just interest but also understanding of Darwin's work. In outline, the initiative started with an opportunity, the 200th anniversary of Darwin's birth, for public engagement with science. This then focussed round the ambitious idea to provide a practical experience for every pupil in the country based on Darwin's ideas. The main thrust is via the route of formal science education by developing 'The Great Plant Hunt', which has provided a 'treasure chest' of activities for every primary school, and the 'Survival Rival' activities for secondary schools. Around this have been built other activities in the science communication field including 'The Tree of Life' sequence which was part of David Attenborough's lead programme

on Darwin for the BBC, and the 'Routes Game' and web-site. Clearly it is too soon to be able to measure the lasting effects of The Wellcome Trust's Darwin 200 programme and it is on a scale that is out of reach for most organisations, but it is an opportunity to learn some lessons on how the interaction of formal and informal approaches might help to enhance public awareness, engagement and understanding of science.

In order to achieve this we need to keep evolving the relationship and explore other opportunities for such complimentary activities because in my view:

- pupil engagement is public engagement - there are still barriers to be overcome;
- there are lessons to be learnt from across the interface between informal and formal education.

Discussion

The discussion which followed centred on a range of issues around 'learning'. This included how learning is measured, described and perceived. The distinction between 'formal' and 'informal' education created debate, with a general sentiment amongst the participants that there is a symbiotic relationship between these two perspectives. The presentation of science as 'fun' within informal learning also caused much discussion, both around the appropriateness of this approach and the image it presents of science. Delegates raised concerns that selling science as fun was a disservice to both science, which can be inspiring on its own merits and forms part of our culture and society, and to students, who accept that not all work is fun or easy and who may end up with an unrealistic perception of what a scientific career involves.

Topics you may like to consider for further discussion:

- How should public engagement continue to evolve?
- What relationship should formal education have with science communication?
- How do ideas about 'fun' impact on the work that you are involved in as a science communicator?

www.britishscienceassociation.org
www.wellcome.ac.uk
www.scu.uwe.ac.uk

Collaboration: relationships for success including partners, consortia and contagiousness of ideas and project formats

Speakers in this session were invited to discuss relationships within science communication and how they can contribute to successful projects. Case studies were used to demonstrate different relationships and how they could affect projects.

Contributors: Paul Cox, National Marine Aquarium, Plymouth, UK
Karen Bultitude, Science Communication Unit at UWE, Bristol, UK

Chair: Gillian Rendle, Research Councils UK

The Value of Collaboration

Paul Cox, National Marine Aquarium, Plymouth, UK

Paul enjoyed a first career in investment banking but was inspired to make a career break through an obsession with SCUBA diving. Whilst studying for a degree in Marine Biology he worked at the National Marine Aquarium as a guide and in five years since graduating has moved up to Head of Science and Learning, picking up a Masters in Science Communication from UWE along the way.

The National Marine Aquarium was the first public aquarium in the UK to be set up as a charity and, as such, operates an education, research and conservation programme that strives to 'inspire everyone to take action toward sustainability and conservation of the oceans'. The aquarium and associated programmes serve as the communication arm of the Plymouth Marine Sciences Partnership (PMSP), a group of seven leading marine science and technology research organisations.

As a resource-limited organisation with aspirations to secure a national profile as a Marine Learning Resources Centre, the National Marine Aquarium relies heavily upon partnership and collaborative projects. Collaboration is appreciated for bringing numerous benefit's; it allows the organisation to access a wide range of skills as and when needed; it creates new opportunities for the generation of ideas and it has the potential to broaden the spectrum of funding opportunities. Overall, collaboration allows the organisation to increase its 'punching weight' and pursue its national and international ambitions.

As a result of the nature of the organisation and its appeal to potential partners, there has been no shortage of collaborative opportunities. It has to be recognised, however, that not all collaborative opportunities are productive or the best use of limited time – there comes a time to be a bit pickier and become more strategic about choice of partners and projects. This means that saying 'no' is sometimes necessary but it is also important not to be too strategic as there

will always be a new idea ready to come out of 'left-field'. The trick is to establish the right balance between strategic planning and opportunism and not to close any doors too tightly.

In looking more closely at potential collaborations, there are various levels of partnership, each of which brings its own potential barriers to success. These are highlighted in very general terms for the sake of discussion:

- Locally-based partnerships can be subject to mis-alignment of objectives – there are, in all likelihood, not that many local organisations that have exactly the same remit as your own and therefore compromise is often required in setting up joint projects and defining outcomes.
- On a national scale, it may be easier to identify partners with more closely aligned objectives, but it is not uncommon to run into a 'battle of the brands' situation where we all want to be equal partners but someone wants to be 'the most equal'!
- Internationally, there are some excellent opportunities but it would be dishonest to pretend that there are not barriers created by communication and cultural differences. Language is obviously a barrier in Europe but also keeping a project running long distance can mean resorting to telephone conferences and web-chats which, especially when combined with language difficulties, can be time-consuming and unproductive.

The PENCIL project, coordinated by ECSITE and funded through the EU 6th Framework programme (see www.xplora.org) is an example of a project that involved all three of the aforementioned levels of partnership. The project was coordinated at an international level between 14 science centres, each of whom conducted an individual pilot project. The aim for the pilot project run by the National Marine Aquarium was to create resources and tools for the UK national curriculum on the subject of climate change through the engagement of a pool of local and national teachers and scientists. The three-year project resulted in the production of Climate Lab (www.climate-lab.co.uk).

So what are the success criteria? A number of 'Criteria of Innovation and Quality' can be viewed in the final report on the PENCIL project, available through the Xplora portal. From a personal point of view, there are perhaps three main criteria that all good partnerships must have:

1. The partners need to have matching objectives – it is important to elucidate and agree these from the outset. It is sometimes too easy to assume that a partner wants to achieve the same thing as you do but as the project progresses, the goals can diverge to a point that the success of the project is threatened or your desired outcomes are diluted.
2. There must be chemistry between partners – success does very often rest upon the chemistry between two individuals rather than organisations. This has the potential to cause problems if people move on and it can play havoc with your desire to be strategic.
3. The partnerships must be symbiotic – parasitism is rarely sustainable with a restricted pool of 'hosts' so a good partnership must work for all partners and benefit all partners.

With these criteria in place and with a mind to being slightly cautious about the potential barriers to success, collaboration is the way forward – certainly, at least, for us.

Meet the Gene Machine

Karen Bultitude, Science Communication Unit at UWE, Bristol, UK

Karen Bultitude is a Senior Lecturer in Science Communication at the University of the West of England, Bristol. She is one of nine national EPSRC Public Engagement mentors and works across a wide range of audiences, methods and media. In 2008 she was awarded the Joshua Phillips Prize for Innovation in Science Engagement.

Following from the wider overview provided by Paul Cox, this synopsis will focus on a specific case study example in order to draw out particular issues around collaborations. In particular, this case study investigates the benefits and challenges of large scale programmes involving multiple science centre partners.

Meet the Gene Machine is a lively drama and discussion event designed to raise awareness of the ethical implications raised by advances in medical genetics. The project was delivered across the UK between October 2006 and March 2008 and was funded by the Wellcome Trust. Working with eight UK science and discovery centres, the project was managed by the Science Communication Unit at UWE and consisted primarily of a discussion activity using drama to stimulate debate about genetic testing amongst students aged 14 – 19 years.

In addition to the live event for school pupils, the activity involved twilight teacher CPD (continuing professional development) sessions as well as extensive classroom resources. In total, over 10,455 pupils participated in a live discussion event, with 498 teachers undergoing CPD training.

The external evaluation of the programme (involving 132 teachers) found that over 90% of teachers judged the discussion to be 'engaging', whilst 99.2% agreed that it was a 'good use of students time'. Most impressively, 100% agreed that they 'would involve students in a similar event again.'

Collaboration Models

In the most simplistic sense, MGM could be viewed as a simple 'hub-and-spoke' model of collaboration, where the Science Communication Unit (SCU) centrally managed the involvement and input of the eight external science centre partners. This approach is summarised in *Figure 1*.

However in our experience this sort of a simple hub-and-spoke model wouldn't have worked due to a lack of ownership by each science centre. To counter this, it was important that key partnerships were developed in each local area. Where possible, these relationships built on existing expertise. For example, the science centres had existing presenters who could deliver the events, as well as good networks with local and regional educators. However, there were gaps in experience, for example understanding of real life experiences of dealing with genetic testing. To plug this gap in insight, local genetics counsellors contributed extensive experience and real life examples to the presenter training sessions. This greatly enhanced the presenters' confidence and ability to place the science in a relevant context for the audiences.

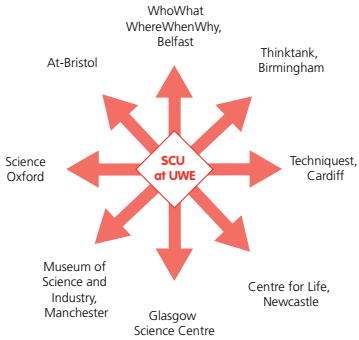

Figure 1 - *Simple 'hub and spoke' model of collaboration*

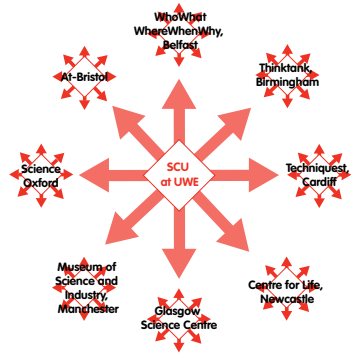

Figure 2 - *More successful 'multi-hub' model of collaboration*

So in many ways the successful model was more like a multi-hub approach, as demonstrated in *Figure 2*.

Challenges

There were of course many key challenges associated with maintaining such partnerships which were encountered within the programme, primarily:

- High staff turnover within many of the partner institutions
- Delegation from 'management' to 'delivery' staff (sometimes without the appropriate briefing/ skills development)
- Maintaining effective communication between the various institutions and staff involved

To overcome these challenges a high level of adaptability was required – in some cases this involved running additional training sessions for staff who joined various partner centres at later stages of the delivery phase. Cost savings made elsewhere, and the large scale of the MGM programme, meant this unexpected element could be absorbed. However additional training sessions may not always be easy to achieve, so teams planning to undertake work with multiple science centres over an extended period of time should plan in a contingency factor for this element.

Multi-level external evaluation was integrated from the beginning of the project. This was crucial in incorporating the opinions of students, teachers, presenters and management staff and meant that issues were highlighted as they arose, and adjustments could be made for each subsequent stage.

Different communication methods were attempted e.g. a monthly newsletter that highlighted key ideas/learning from different centres. This made some attempt towards a two-way communication facility within the project team (science centres were encouraged to submit ideas or experiences), although admittedly there were occasionally difficulties in getting content from all of the partners.

Clearly defined contracts were a bureaucratic burden in the early days however made a significant difference later in the project.

Sustainability and contagiousness

The most critical indicator of success is that the programme continues to be delivered by various science centres well after the core funding has come to an end. The venues involved have judged Meet the Gene Machine to be worthwhile enough to continue delivering at their own expense, and now that word of the activity has spread, some schools are even willing to contribute directly to the costs involved. In fact new science centres have even come on board, both within the UK and internationally, adding to the reach and success of the programme.

Through the project evaluation various reasons for the successful sustainability of the event format were identified:

- MGM built on existing strengths and motivations of the partners involved.
- Each centre was provided with central support (training, resources etc.) but still maintained ownership of their own event format and structure.
- The main costs were in the initial development: once the programme was running in a particular centre it was very easy to continue – which represents great added value for all concerned.

Resources

Further information about MGM is available for public download from the Resources section of the SCU website (www.scu.uwe.ac.uk). There you can find:

- a copy of the script
- the teacher's resource pack
- presenter materials
- full evaluation materials

Discussion

The discussion following this session centred on the practicalities of collaboration. There was general agreement that collaboration was valuable and preferential in certain settings, for example where funders or the projects' overall quality required it. However, delegates discussed a number of aspects raised by the two speakers, including how useful and practical it can be to have legal contracts agreed between the partners; organisational processes that can aid and make more efficient the selection of partners for collaboration and the implications for Intellectual Property and ownership of project outcomes.

Topics you may like to consider for further discussion:

- How does your own organisation select and works with its partners, could this process be improved?
- What potential benefits does collaborating on projects offer for your work? Is it an area you plan to expand?
- Why you might have concerns or constraints around collaborating and how these can be overcome?

www.national-aquarium.co.uk
www.scu.uwe.ac.uk
www.rcuk.ac.uk

Adaptation: within venues, cultures and contexts

This session showcased science communication activities that have successfully moved on from their initial focus by transferring to new venues, cultures and contexts. Speakers highlighted how and why these activities were able to adapt to their new circumstances.

Contributors: Jan Riise, Göteborg Center for Public Learning and Understanding of Science, Sweden
Wendy Sadler, science made simple, UK

Chair: Kat Nilsson, The Dana Centre, UK

Adaption

Jan Riise, Göteborg Center for Public Learning and Understanding of Science, Sweden

Jan Riise is the president of European Science Events Association, EUSCEA, and a project manager for science communication projects. Currently Jan works with the Göteborg Center for Public Learning and Understanding of Science, as well as in European 'science in society' projects, funded by the European Commission, under the EU's Framework 7 funding programme.

This article takes a case study approach to considering the theme of 'adaptation', based on my work within the Göteborg Center for Public Learning and Understanding of Science, the International Science Festival Göteborg and the European Science Events Association, EUSCEA.

Reaching across cultures

Cultural adaptation is an important facet of science communication – in order to succeed, the messages and outcomes of any message to be communicated need to be adapted to suit the local culture and customs. At the Göteborg Center for Public Learning and Understanding of Science we have recently been working to identify how best to adapt European approaches to science communication to the Chinese perspective. The unparalleled growth in the Chinese economy over the last three decades has to a large degree been fuelled by the constant migration of workers from rural areas to the large and rapidly expanding Chinese cities, such as Beijing, Shanghai and Guangzhou. Chinese partners at the Sun Yat Sen University in Guangzhou are studying how the level of 'useful scientific literacy' can be improved among the workers and their children, e.g. by adapting science communication efforts to the specific target group. This would possibly then enable them to use science to improve their lives, in terms of their own health, their children's education and opportunities to take more active part in society.

Shared learning – the Science Events perspective

Science festivals and events are becoming common place throughout Europe, with activities ranging from one-off celebrations of science in a local area to national 'science and technology weeks' and similar. EUSCEA (the European Science Events Association, http://www.euscea.org/) aims to support and encourage the exchange experiences about the organisation of such informal learning events. In 2003-05 EUSCEA carried out an extensive survey among some 25 of its members. The result was published in the 'white book', Science Communication Events in Europe, that was released at the 'Communicating European Research' conference in Brussels in November 2005. The survey included an analysis of the purpose and philosophy statements of the included science festivals and events. Practically all events had some statement regarding 'raising the awareness of science' – formulated in different ways and different languages, but with basically that content. However, almost all festivals also had additional purposes; thus 'adapting' the science communication idea to local and/or regional and national needs and objectives. Such goals include 'city marketing', 'networks between industry and academy', 'national coverage' and 'meeting-places for scientists'.

As a case in point, the first Science Festival in Göteborg was arranged in 1997, since then it has been arranged on an annual basis in April or May (thus adapting to other events, public holidays etc). Relatively soon it reached an audience of about 100,000 visits per festival and 300-500 individual activities, a level that makes it one of the biggest science events in Europe.

How to ensure adaptability within an activity

2WAYS is funded by the European Commission and overseen by EUSCEA. It is a two year project involving 30 partner organisations and members of EUSCEA, who are working in pairs across the network. The objective is to create a resource of interactive presentations of contemporary life sciences research which will then be made available to the wider community. This approach involves applying and testing the adaptability of science communication activities in several dimensions.

First of all, each partner within the 2WAYS programme will adapt relatively advanced scientific objectives, methods and language to contexts that are familiar to public audiences and selected target groups. Secondly, the activities themselves will then be adapted to formats – and locations – that encourage interactivity, dialogue and engagement. Thirdly, the presentations must be adapted – or adaptable – to possible future events and presenters. Part of the project is the production of a 'cook-book', instructions and guidelines explaining how to recreate the presentations in alternative venues. Finally, the presentations will be available in a format that makes evaluation possible and meaningful. We recognise that it is important to assess the impact of the work and at least get some indications if the adapted presentations were interesting and entertaining.

Selected projects include research in systems biology, brain plasticity, pandemia, vaccines, stem cells, ethical issues of animal biotechnology, and allergies.

Adaptation through the choice of venue

Marketing professionals at business schools tell us that there are 4 'P's' that can be considered for a better market penetration, i.e. in our case reaching a larger part of the selected target group. The four P's are Product, Price, Place and Promotion – and these aspects of dissemination can each be adapted to the intended outcome. In the science communication case, 'Price' is frequently not an issue since many activities are funded externally, thereby provided free to the participants. 'Product' means, for example, the adaptation of a lecture to something more easily accessible by the target audience, such as a discussion or interactive workshop. 'Promotion' is about the resources spent on telling the target group that there is something going on. It is however in 'Place' that a real opportunity for adaptation occurs - an opportunity to change the outcome of our efforts just by thinking about which location it is delivered in.

The potential advantages provided by changing the location of the event are demonstrated by visitor evaluations made at the International Science Festival Göteborg. Feedback indicates that the choice of venue has an impact regarding the visitors' profile in terms of age, education and place of living. Most encouraging were the results from the 'science festival tent' in a park close to one of the main pedestrian and shopping areas: in two consecutive evaluations this location had more young people from underprivileged suburbs than on average. This is a traditionally hard-to-reach audience, but by merely changing the location of the activities to somewhere more amenable to the participants, the increase in participation was noticeable. This result certainly supports the perspective that we should consider 'adaptation' of events in as wide a context as possible.

'visualise – the beauty of science'. A non-verbal science show - adaptation and evolution in action

Wendy Sadler, science made simple, UK

Wendy Sadler is the Director of 'science made simple', a science communication company that specialises in inspirational and interactive science performances, and in working with researchers on translating their research to a wider audience. Wendy was awarded the EU Descartes Prize for 'innovative action in science communication' in 2007.

science made simple is a company with three parts to its mission:

- to inspire the next generation of scientists and engineers
- to engage a wider public with STEM as part of popular culture
- to be a STEM translation service between researchers and the public

Much of our work is done using what could be classed as 'traditional' science shows – that is, interactive performances showing live demonstrations, using volunteers and engaging the audience with mass experiments or multi-media activities. These shows are usually run by one presenter and are designed to work in a school hall location with very little control over the theatrical facilities that will be available.

In 2005 two thoughts collided to create an idea for a new kind of science show. Through work we had done with the British Council overseas we had found that when working through a translator you use much less verbal communication and are more reliant on the impact of the demonstration and your non-verbal communication techniques. Secondly, some research I completed on the long-term impact of science shows suggested that visually 'curious' demonstrations are the ones that remain in the memory most effectively. We combined these two ideas together and added in some further inspiration from seeing large-scale demos set beautifully to music by a German group called 'Physikanten'.

Phase 1

With support from NESTA and the IOP as part of Einstein Year (the UK arm of the International Year of Physics in 2005) we decided to try out this new format. The aims of the show were to create a science–based performance that would reach new audiences, cross language barriers, push the boundaries of our own creative skills and then to evaluate the approach and share the results with other practitioners.

The show in its first phase was all about the demonstrations, with the performer staying fairly discreet, being on stage simply to activate the demonstration. Popular favourites were taken and scaled up or cameras were used to project smaller but enticing demonstrations onto large screens. Each 'chapter' of the show had a different scientific theme and was concluded with a video montage of where the phenomena occurred in the real world. We wanted to ensure that the show wasn't just about flash-bang-wow equipment, wanting it to showcase the beauty of simple and small things as well.

The evaluation was positive on many aspects such as the emotive potential of the show, the novel format and the use of music and cameras. In addition, the perceived novelty of people seeing these effects live on stage rather than just filmed earlier and shown on screen was popular. However, there were large technical problems and the audiences did not like the remoteness of the presenter, who had no interaction or engagement with the audience. As well as realising that we needed much more help on the technical production of the show, we also realised that we needed some artistic direction to ensure the audience engaged with the performer on the stage as well as the demonstrations themselves.

Phase 2

With financial support from the British Council we formed a partnership with The Royal Welsh College of Music and Drama to bring in both technical and artistic expertise. The show was reviewed with the help of a guest Director, who brought in more recognisable characters and

a stronger narrative. In addition, students on the technical courses at the College became our technical team. The College valued this opportunity as the challenges we had in staging science demonstrations in this way gave them a completely novel set of learning opportunities for their students. The College were keen to promote the performance as part of their Welsh showcase at the Edinburgh International Fringe Festival and we secured additional financial support for this performance from the EPSRC.

In its second phase the show consisted of two performers assuming likeable characters where there was some rivalry on 'who could do the best experiment'. The performers (who are both scientists by background, not actors) received additional training in physical theatre techniques and clowning to build their skills for the new roles.

The show was a huge success at Edinburgh, becoming an official 'fringe sell-out'. We were short-listed from over 300 acts for a Total Theatre Award for 'experimentation'. The Welsh College sold more tickets for our show than all their other Welsh performances put together, and the show then proceeded to visit 9 countries as part of the British Council's 'Beautiful Science' project, reaching over 11,000 people and performing in theatres of 300-500 seats.

Phase 3

After completing the European tour, the Scottish Executive supported taking the show to Edinburgh again and then to a further 3 theatre venues in other areas of Scotland. For this stage the Welsh College worked with us to make the production more cost effective for theatres. The characters and content of the show were again reviewed by a different 'guest director', resulting in the show being more fluid, with better positioning of each experiment within the overall narrative. However, despite having some money to subsidise the tour we found it very difficult to get small to medium sized theatres to book the show. Often their seating capacity would not generate enough income for them to cover the costs of bringing us in and therefore they would not take the risk on an 'unknown' theatre company. Visualise:re-loaded was then taken to Edinburgh Fringe 2008 where again ticket sales were good and we achieved a four- and five-star review from the key broadsheets.

Thoughts on the future

Despite a real buzz of interest about the innovative nature of the show and various enquiries from theatres in the UK and overseas (e.g. Chicago, Malaysia, and Korea) we have yet to identify a model of operation than covers our costs to tour the show, let alone to help with the overheads and time taken to secure bookings. The cost of the production is often prohibitive, as is the long set up time and technical requirements of the venue unless they have a proper theatre space. In addition, our aim was always to focus on non-science events so as to reach a non-science target audience but that has proved more difficult in practice.

Theatres appear suspicious that they might not be able to sell enough tickets for a science based production. This is in interesting contrast to shows such as 'Brainiac Live' which regularly sell out 500+ seater venues at ~£12 per person – potentially highlighting the value of a recognisable TV brand.

The show has been proven to adapt well to new audiences to science – and audiences who prefer to learn in a very visual, non-verbal way (whether that be non-English speaking audiences or people with special educational needs). However we are unsure whether it can become commercially viable without further significant investment in marketing and tour booking. The main problem therefore of adaptation has not been adapting the content of what we offer, but in adapting our brand and reputation so that theatres have confidence that the public will buy tickets for this kind of show.

Discussion

Participants were keen to discuss the benefits and constraints of audience targeting, which whilst excluding some audiences from a particular activity, was seen to be a useful tool. Visualise, as an example, prompted discussion around similarities between science communication initiatives and artistic endeavours. Delegates highlighted the frequent conflict of having dual aims in science communication: both learning and evoking an emotive response. Contrasting this with a theatre production or other creative experiences where the audience is free to leave with their own ideas, integrating the experience into their own current thinking. It was recognised there may be some useful learning to come from the creative arts in terms of how quality is assessed and how artists accept that each audience member walks away with a unique and personal experience.

Topics you may like to consider for further discussion:

- How didactic are the science communication activities you are involved with?
- How could activities you have developed be amenable to evolution and change by others?
- What professional and personal ramifications might the utilisation or the adaptation of your work have for you?

http://www.euscea.org/
www.sciencemadesimple.co.uk
www.sciencemuseum.org.uk/antenna
www.danacentre.org.uk

Demonstrating impacts: impact, metrics and going beyond evaluation

Evaluation of science communication projects is now the norm, but what does evaluation tell us about the impacts of these activities on participants and deliverers? Speakers in this session were asked to discuss the latest thinking on capturing the impacts of science communication activities and how this links to evaluation.

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David Shakespeare, Square 2 Learning Ltd, UK

Chair: Ros Mist, Science Community Representing Education, UK

Assessing long-term impact of science engagement: Can it be done yet?

Ben Gammon, Ben Gammon Consulting, UK

Ben Gammon worked for 15 years at the Science Museum as Head of Visitor Research and then as Head of Learning. He sat on the MLA's steering group guiding the development of their Inspiring Learning for All framework and developed systems for assessing learning from Science Museum exhibitions and live interpretation. Ben is now an independent consultant specialising in interpretive planning and visitor research.

Understanding the long-term impact of science engagement activities (SEAs) is clearly important. Yet making reliable and valid assessments of such long-term impact is far from straightforward. Most studies which have been conducted are of questionable use since they have been conducted ahead of any clear understanding of what impact can reasonably be expected. To put it another way, we do not really understand what it is we are looking for nor how to look so it is hardly surprising that we are struggling to find it.

Measuring long-term impact of science engagement is not like measuring the long-term impact of crime reduction initiatives, health campaigns or even new approaches to school based education. In all these cases there are clearly agreed definitions of what constitutes a crime, heart disease, or a particular grade in a GCSE. Admittedly there are many subtleties to such measurements but nonetheless there are agreed standards, norms and methods of measurement. Although there are elements of ambiguity in general we know what is meant by a high cholesterol level and how such levels would be measured.

This is not the case when it comes to assessing the long-term impact of science engagement activities. The quantitative and qualitative nature of this impact has not been properly defined, making any assessments largely meaningless. For example consider the following questions in terms of what would be deemed as a successful science engagement initiative:

- Over what time period should the impact of an SEA be measurable – weeks, months, years, decades?
- How much impact is deemed to be enough? If one person out of an audience of 10,000 shows evidence of impact is this enough? If not one person then what number: 10, 100, 1,000? And how much impact should be observed per person for the initiative to be deemed successful? Does any evidence whatsoever count as enough?
- How much more impact should an SEA costing £1 million expect to deliver compared to one costing just £10,000?
- How should such long-term impact manifest itself? Is simply remembering the experience enough? Does everything we remember have a significant impact upon us or is some of what we can recall merely trivial episodes?
- Can we recall everything that has had a significant impact upon us? How much of your formal schooling can you actually recall? Does the fact that you cannot recall a great deal of it mean that it has had no impact or simply that you can no longer recall when that change occurred to your attitudes or understanding?

The true value of science engagement is often said to be its capacity to inspire interest, yet research has consistently shown that most of the people taking part in such activities are already interested in science and are attending in order to sustain that interest. How then do we assess the vital role of science engagement in sustaining interest given that there will be little or no change to measure?

How do we untangle impact of the particular SEA we are seeking to study from the myriad of other experiences which will have effects (both positive and negative) upon the same indicators we are likely to use? How should we take account of the very different pre and post SEA experiences and interests of our visitors? How do we determine what has been caused by the SEA and what is caused by TV programmes, experiences in school, books, web-pages etc? Remember that our visitors will spend vastly far more time watching TV, surfing the internet, reading books, newspapers and magazines than they will have spent engaged in the SEA. We are looking for a small signal against a very large amount of background noise.

Without a robust theoretical model of the impact a successful SEA should have over a specific period of time it is impossible to draw any meaningful conclusions from any long-term studies.

Other more practical questions are also sorely in need of an answer:

- Is it reasonable to expect science communicators without professional training and with extremely limited resources of time and money to try and conduct complex longitudinal studies? Or should these studies really be done by professional academic researchers?
- Is the data collected from a study of long-term impact actually of any use to anyone? Is it possible to identify why a particular science engagement activity did (or did not) have an impact – i.e. precisely what it was that did or did not work? Without this information the data is surely useless since it is impossible to draw any practical conclusions about how to improve the practice of science engagement.

- Unless a sponsor knows not only whether but also why a particular initiative was successful how will they know what in future is a good project to fund?

If science communicators and their sponsors cannot identify why something was successful or unsuccessful then what is the point of assessing the long-term impact? The money will already have been spent and without an understanding of what needs to be changed and what preserved, nothing has been achieved.

This is not to say that there is no value to assessing the long-term impact of science engagement. Rather it is an attempt to highlight that at present we do not know what we are looking for, how to look for it or really why we are conducting these studies. This is not so much a matter of putting the cart before the horse. It is more like trying to hitch the horse to the cart before the wheel has been invented.

Do we know what we want? Will we know if we get it? Issues in evaluating science enhancement and enrichment activities provided for schools

David Shakespeare, Square 2 Learning Ltd, UK

David Shakespeare is a science education consultant to teachers, schools and organisations such as the DCSF STEM Programme, the QCA, STEMNET and the Science Learning Centres network. His work includes evaluation of the impact of educational initiatives from the teacher/ school perspective, and the development of strategies to align the aspirations of science-related educational support providers with those of schools and their learners.

Evaluation is a determination of worth or significance, and involves criteria against a set of standards. In the field of science enhancement & enrichment (E&E) activities provided for schools, it is a lack of criteria and standards which currently hampers effective evaluation of this provision. Unfortunately, it would be very problematic to develop common standards to try and fit all types of E&E. But worse still, what is missing in many cases is a lack of clearly-defined, achievable objectives to set out a provider's own standard for what they are hoping to achieve. For a given E&E activity in a school, the provider and school are both responsible for trying to gauge impact, but too often neither party decides on meaningful objectives against which to measure progress. However, there is a possible solution – and it lies with both the provider and the school.

For E&E providers (and those who fund them), there are many reasons to support in-school E&E activity, and they seem to centre on (one or more of):

- Engaging and enthusing young people about science
- Supporting the formal science curriculum
- Showing learners real-world applications of curriculum science
- Raising awareness of specific scientific topics or issues
- Encouraging learners to consider science-related further study and careers

Science teachers themselves would generally agree with this list. However, that would disguise the fact that teachers are likely to expect a greater emphasis on certain objectives than others (e.g. 'For this year group, at this point in the school term, we want to improve attitudes to science but are less concerned about influencing subject choices'). Teachers are also just as likely to have other objectives in mind - such as raising the achievement of certain groups of pupils, or to satisfy their school's requirements to work with outside agencies, and so on. Either way, the broad nature of the provider's initial objectives and the possibility that the school has different objectives creates a misalignment - meaning that there is no clearly agreed standard against which to compare, thus making it difficult to assess progress at all.

Looking at how the most limited evaluations are carried out by providers, they may involve a simple head-count (e.g. 'We provided for 1,252 pupils last year'), or uptake numbers (e.g. 'We are working with 53 schools in 11 local authority areas'), or re-bookings (e.g. '23 schools asked us back two years running'). They may also take as evidence the instantaneous or anecdotal response of pupils and teachers (e.g. 'The pupils had a great day and seemed to get a lot out of it'); or ticks and comments from on-the-day questionnaires. While all these play a part, they are simple measures of throughput and reaction to the activity, and have far less to say about learning, potential changes of behaviour and the ultimate outcome for the participant – even though that may be what was desired in the first place by the provider and those that fund them.

Evaluation methodology in schools is different. In recent years, 'assessment for learning' pedagogy and self-evaluation approaches mean that state schools have evaluation closer to the heart of what they do. Effective teaching involves tightly defined objectives for each lesson – and teachers try to gauge pupil progress against them. Periodic assessment information is analysed and used to inform future provision. Through well-established self-evaluation processes, science departments in schools are more used to looking for evidence of the effects they may be having. Curiously, these approaches to evaluation are not applied by many schools when E&E providers visit – and it is an opportunity missed.

To move on from where we are, providers could be:

- Frequently asking themselves 'How often, and at which stages, do we try and gauge the longer-term effect of what we are doing in this activity – i.e. not just the reaction of participants, but their learning, changed behaviour and final outcomes?'
- Considering the question 'What's in it for me?' at all levels to help express their initial objectives for the activity (i.e. What's in it for pupils, teachers and schools?).
- Explicitly promoting these initial objectives and referring them to any school with whom they start to work.
- Asking these schools about their objectives for the E&E activity – and negotiating a sense of what success might look like in the school by together defining some intended outcomes (e.g. 'By the end of this E&E activity we intend that the number of Year 9 pupils reporting that they will be choosing Applied Science in Year 10 has risen by 20%'; and 'By the start of Year 10, 10% more pupils have actually chosen Applied Science').

- Asking the school about the part they can play in gauging progress (e.g. in the case above, using the Year 10 course uptake data, perhaps cross-referenced to those who indicated earlier their intention to take Applied Science); asking schools how the provider can help them in the process; and agreeing how and when a review will be undertaken together.

This all requires a small but significant cultural shift by the provider, and more negotiation before provision. While it also appears to put more work on the school, I believe many teachers recognise the importance of evaluation – and will feel it helps improve their decisions regarding the use of external provision of E&E.

This is not, however, a perfect (or a cheaper) solution to the issues. Longer-term evaluation is always more 'messy' and requires greater commitment. But unless we recognise that objectives and intended outcomes are not one-size-fits-all as defined by a provider, but that they are specific to the provider-school relationship, we will all find it hard to assess if E&E activities are worthwhile.

In future, I would hope the questions 'Do we know what we want? Will we know if we get it?' are part of the first conversations between a provider and a school when it comes to science enhancement and enrichment – and any answers should then be meaningful to both of them.

Discussion

The discussion began with a number of delegates agreeing that evaluation as it currently stands is less than ideal. Delegates probed and made suggestions around how critically projects should be reviewed and compared, the pros and cons of internal vs. external evaluation, the need to acknowledge failure and the value in publicising evaluation findings more widely. Differing evaluation requirements placed on scientists who communicate, as opposed to science communicators, provoked consideration and delegates also discussed the role that funders might play in encouraging higher quality evaluation as opposed to simply commissioning more projects. In this session, as well as others, the role of Generic Learning Outcomes was suggested as a mechanism to frame evaluation across the field however consensus was not reached as to whether this would answer the questions posed by the speakers in this session.

Topics you may like to consider for further discussion:

- What approaches do you or your organisation take to evaluation?
- How much you think mistakes as well as successes are shared across the science communication field?
- What does a generic framework such as Generic Learning Outcomes mean for your work?

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Repositories of knowledge: sharing knowledge to avoid reinventing the wheel

In this session participants were asked to share how their projects and activities were recorded and documented so that others can potentially learn from their experiences. Speakers used examples from their own work to examine existing instances of documentation and sharing knowledge, whilst also looking at how this could be taken forward in the future.

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Juliet Upton, the STEM Directories, UK

Chair: Maggie Leggett, Centre for Public Engagement,
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The NCCPE project

Sophie Duncan, National Co-ordinating Centre for Public Engagement (NCCPE), UK

Sophie has worked in public engagement for over 15 years, and is the Deputy Director of the National Co-ordinating Centre for Public Engagement – a large scale project to enable the public to play a more interactive role in the work of higher education institutions. A physicist, she has worked at the Science Museum, NESTA and the BBC, where she managed the creation and delivery of national learning campaigns including People's War and Breathing Places.

The Beacons for Public Engagement

The National Co-ordinating Centre for Public Engagement is part of the Beacons for Public Engagement project, which was launched in April 2008. The project is made up of the NCCPE and six Beacons: Newcastle and Durham, Manchester, CUE East (UEA), UCL, Wales and Edinburgh Beltane. This four year project is funded by the UK higher education funding councils, Research Councils UK and the Wellcome Trust. The NCCPE is also supported by the youth volunteering charity 'v', to deliver a strategic project linked to student volunteering. The NCCPE is a partnership between the University of Bristol and the University of the West of England (UWE). A key part of our role is to co-ordinate, capture and share learning between the Beacons and beyond.

The NCCPE's vision is of a higher education sector making a vital, strategic and valued contribution to 21st-century society through its public engagement activity. The NCCPE's role is to co-ordinate, capture and share learning between the Beacons and beyond. Our mission is to support universities to increase the quantity and quality of their public engagement activity, and

we have three strategic aims:

1. **To inspire a shift in culture**

- Support universities in bringing about strategic change that embeds public engagement
- Identify, develop and disseminate evidence-informed practice

2. **To increase capacity for public engagement**

- Broker and encourage the sharing of effective practice
- Capture learning from the Beacons and beyond and share it widely

3. **To build effective partnerships**

- Encourage partners to embed public engagement in their work
- Inform, influence and interpret policy
- Raise the status of public engagement

Repositories of knowledge

How do we make use of the many resources, evaluations etc that are already out there? There are a number of factors that influence our ability to learn from what others have done. These include:

- **Time:** How much time do we have to access the multitude of content that could inform our approach?
- **Accessibility:** How easy is it to find relevant research and then apply it to our own situation?
- **Motivation:** Many of us want to learn from other people's work - but not always. Sometimes we are captivated by an idea we really believe will work, and we dismiss evidence to the contrary with the belief that our idea is different in an essential way from previous projects. I call this the 'passion of the pioneer'. People are constantly creating new ideas and new ways of approaching issues. To some extent many of us want to reinvent the wheel – and reinvent it in a way that revolutionises how we travel.
- **The importance of people:** People are really important in the process of learning. Talking to someone for ten minutes about their project can enable you to learn things that would never be captured in a case study or report. It can also help you apply the knowledge gained.

How can we at the NCCPE develop shared learning?

- **Networks and events:** Part of the work of developing shared learning is about bringing people together. This might be face to face, online, or anywhere that enables personal connections to be made. An important group of people for any network are the live wires

– those with passion and experience who can help mediate the available content and connections for people. Our events programme will focus on creating opportunities for shared learning, and provide opportunities to develop relevant resources for the sector

- **Action research:** We will be running an action research group process – where groups of people from across the UK will be engaged in group discussions around the question: 'Why should and how can universities embed public engagement?' Actions will emerge from these discussions – either group actions (e.g. commissioning a piece of research) or individual actions (to be played out within the participant's institution). These actions will be reflected on by the group. At key points the groups will be brought together alongside others who have not engaged in the process, to reflect on what has been learnt, and to explore emergent themes. This may lead to the creation of new groups and projects, and the process continues.
- **Content:** Part of our work is to create an evidence base for public engagement – in order to help validate its importance and relevance to HEIs, communities and academics, staff and students.
- **Syntheses not encyclopedias:** With such a wealth of content currently available we need to ensure that we provide syntheses of this knowledge – providing helpful pointers for people – without the need to read through many pages of reports etc. Even our syntheses will be summarised into headline documents for those with little time, but lots of interest. It has been mentioned in other sessions that it would be helpful to synthesise some of the findings from evaluation of public engagement activities – and this is something we are keen to explore.
- **People not reports:** Whilst reports are important, we all know that it is people who really help make content relevant and accessible.
- **Stories not stats:** Stories not stats: Stories are really important – they are what people remember. Whilst statistics are important for a whole host of reasons, stories make the statistics matter. If I tell you that 4000 people volunteered to help with the People's War project it doesn't really sound very significant. However one of those volunteers was Arthur. Arthur heard a call for people to contribute their World War Two story to the People's War archive. He shared one of his stories at his local museum and enjoyed it so much that he decided to volunteer to help other people record their memories. When the BBC roadshow moved on, the museum set up a stand for Arthur to continue to gather stories. Arthur went on to develop IT skills, and was hugely effective in encouraging others to take part in the project. Arthur was an amazing volunteer – but he wasn't the only one. Over 4000 other volunteers like Arthur were engaged in the project. Never underestimate the importance and value of stories – they capture hearts like statistics never can.

What about you?

How would you like to be supported in developing your own public engagement activities? If you would like to share thoughts on how best the NCCPE can inspire people to engage the public we would be delighted to hear from you at Nccpe.enquiries@uwe.ac.uk

The STEM Directories

Juliet Upton, the STEM Directories, UK

Juliet Upton is an independent consultant specialising in project management, PR and marketing. Prior to consultancy, her many roles included: The Royal Society's first Head of Press and Public Relations, senior communication roles at The Engineering Council and at ETB and Chairman of STEMPRA from 2002-2007.

The STEM Directories provide clear, current and relevant information on science, technology, engineering and mathematics (STEM) engagement activities for UK schools, colleges and home educators.

Created in direct response to teachers' needs, the first STEM Directories were published in September 2008 as three separate hardcopy volumes for Science, Mathematics and Engineering & Technology. They comprise a collection of schemes and activities provided by organisations from across the UK that aim to enhance and enrich the curriculum.

The main benefits of such schemes are that they are usually based around events or experiences that cannot be delivered with standard school contacts and resources. Moreover, each activity is linked to the curriculum so that the impact of the experiences and outcomes can be sustained. To qualify for inclusion entries must satisfy key criteria relating to health and safety, sustainability in funding and availability. Additional resources such as information about the benefits of STEM enrichment and enhancement for teachers, schools and students, national science and engineering week etc were listed at the back of the original hardcopy Directories.

As part of the national STEM programme, this project has provided a rare and unique opportunity for the science, technology, engineering and maths communities to come together to meet a common objective. With the key organisations in the UK STEM Community – SCORE (Science Community Representing Education), ACME (Advisory Committee on Mathematics Education), The Royal Academy of Engineering and STEMNET, the STEM Directories were created, managed and developed by a consortium comprising The Royal Institution of Great Britain, The British Science Association and University of the West of England (UWE) at Bristol.

Research over recent years has shown that there are an extraordinary and vibrant range of projects, programmes and initiatives which have as their aim, the support and improvement of STEM education in schools and colleges. However, the absence of a single point of reference and a consistent approach on the part of STEM enrichment and enhancement (E&E) providers of all these activities means that the sheer scale and variety of provision is daunting.

Teachers and lecturers have said unequivocally that they need:

- A one-stop shop approach;
- Clear coordination and signposting of support and resources which they can trust;
- Events or experiences that cannot be delivered with school contacts and resources;

- Schemes and activities that are relevant to them and their students;
- Ways to tie these to the curriculum so that the impact and outcomes can be sustained;
- Links with industry that makes the curriculum relevant.

The Directories aim simply to provide clear, easily accessible information for schools and colleges, with enough detail for teachers to identify quickly and easily the activities and support that are likely to meet their needs. Following the first print edition and feedback from teachers and providers, phase two was launched in January 2009 to create the first online STEM Directories for launch in June that year.

New features include an easy-to-use online registration system for providers to input information about schemes, inclusion of local schemes (previously the focus had been on UK-wide and regional ones) and a website that provides good visibility and enhanced functionality for STEM E&E providers to showcase their schemes. In addition, in order to begin to encourage more effective evaluation of schemes across the sector, updated criteria were created in January 2009 with a requirement on STEM E&E providers to monitor numbers of schools, teachers and students involved in their schemes

The STEM Directories project is committed to sharing knowledge and best practice. The fully searchable, easily updated online resource is also a good medium for maintaining communication with providers. The website enables the project team to report web analytics back to STEM E&E providers from teachers, and for teachers to share and discuss experiences of schemes through a user comment discussion forum.

Additionally, the project is collaborating with the National STEM Centre at York which is building the largest physical and online collection of STEM teaching resources in the UK. The website facilitates capture and discussion of best practice in evaluation and through close collaboration with STEMNET, the project will work with teachers to inform the E&E debate. Finally, in 2009 the project is conducting research – a gap analysis - to understand better the entire STEM E&E landscape and inform potential future directions.

The online STEM Directory launches in June, with some significant challenges ahead.
For example, how should we use the information collected on evaluation – what and who is it for? How should providers respond to criticism from teachers about availability, under-capacity of their scheme or cost? How should we share the information gathered about the gap analysis and what actions should be taken from its outcomes?

Discussion

A significant proportion of the discussion following these contributions related to action research. New to some participants and familiar to others, it was felt that action research would, by its very nature, help to disseminate findings from project evaluation, providing there was a set of themes around which action research could be undertaken. The Generic Learning Outcomes (GLOs) were suggested as one such framework that was already in use in the sector. However, some participants questioned the value of action research in producing more generic and usable results which led to conversations about archiving and repositories. While there was agreement on the need to create archives, document projects and make this information available to others it was noted that the information needs to be presented appropriately and therefore the audience for any archive needs to be clearly defined.

Topics you may like to consider for further discussion:

- How have you shared any learning in science communication projects you have been involved in?
- What opportunities and constraints might you anticipate in sharing outcomes of your research with others?
- What types of information might you find it helpful for such archives to store or share?

www.stemdirectories.org.uk
www.bris.ac.uk/cms/cpe
www.publicengagement.ac.uk

Creating a Sustainable Future for Science Communication: forming partnerships, linking theory and practice

In this discussion session four 'agitators' with controversial or challenging views were asked to stimulate conversations about the future direction of science communication. All delegates were then invited to contribute their reactions, views, opinions, and experiences to the discussion that followed. The following excerpts relate to the views that they shared or the reactions of the groups which discussed them.

Agitators: Justin Dillon, King's College, London, UK
Catherine Aldridge, Catalyst Learning and Communication, UK
Lesley Paterson, Royal Academy of Engineering, UK
Savita Custead, Bristol Natural History Consortium, UK

Chair: Helen Featherstone, Science Communication Unit, UWE, Bristol, UK

What does science communication need to do to be taken seriously?

Justin Dillon, King's College, London, UK

Justin Dillon is a Senior Lecturer in science and environmental education. He has researched science engagement projects at the Science Museum, the Natural History Museum, the Royal Society and museums and science centres in Europe and the USA. Justin co-edits the International Journal of Science Education and is Chair of the London Wildlife Trust.

50 years ago CP Snow gave a Rede Lecture entitled 'The Two Cultures' in which he articulated the emergence of a division between scientists and literary intellectuals. We haven't really come very far since 1959. We haven't even come very far since 1989 - this week we celebrate the twentieth anniversary of the Fleischmann-Pons effect, the suspension of critical reasoning by journalists faced with confident scientists and a potential front-page story: 'cold fusion'. In a week where a mainstream newspaper seriously attempts to explain 'How using Facebook could raise your risk of cancer', now is an appropriate time to look at what science communication has done and what it should aim to be doing in the future.

So, my question is What does science communication need to do to be taken seriously?

To be taken seriously by scientists, science communicators need to stop being perceived as 'dumbing down' science: 'The indulgent and well-financed 'public engagement with science' community has been worse than useless, because it too is obsessed with taking the message to everyone, rarely offering stimulating content to the people who are already interested' says Ben Goldacre in Bad Science.

Even some of the scientists who engage with the public think that evaluation, a core income stream for some science communicators that separates being 'freelance' from being unemployed, is a waste of time. To be taken seriously by funding agencies, science communication needs to show that it's having an impact. In the last Research Assessment Exercise, science communication was barely visible within science units of assessment. In the next one it's almost certainly going to be less visible. But the critical audience is science communicators themselves. If we don't take ourselves seriously then no-one else will. Here are some suggestions for raising the bar in science communication:

Firstly, we must be clear about the purpose of science communication. Is it about increasing the number of people studying science or becoming scientists? If so, most of the efforts of science communicators are wasted unless you're working with kids aged 9-12. Evidence from the US suggests that's when most kids' interests have been settled.

Is it about enabling the whole population to understand science? Just how much science would you have to know to make a reasoned decision about nuclear power, GM crops or abortion? Even experts disagree, so the idea that the public will ever understand 'enough' science is nonsensical.

Secondly, develop a clearer understanding of what it is that we do – I'm not even sure that science communication is an appropriate phrase to use. Many self-confessed science communicators never meet their audiences except at book signings or public lectures. Some never meet their audiences – you don't communicate with viewers and listeners – you communicate at them – and that's not science communication – that's presenting.

Abandon the term science communication – decide for ourselves whether we are science popularisers or science educators. If you're the former, use one set of indicators but if you're serious about science education then get real about how much time it takes to teach people stuff, especially people that you don't know.

Thirdly, develop an appreciation of the existing evidence base – how many of us subscribe to the existing science communication journals? How many of us read science education journals? If you value knowledge and value research, then value research in the very fields that might inform your work.

Fourthly, change your identity – shift the focus and the discourse of your academic courses away from the media and towards the public. One Science Communication MSc student handbook that I looked at mentions the word 'media' 41 times and the word 'public' once. And stop giving yourselves prizes for doing nothing special.

Finally, develop an evidence base of the impact of science communication – this is going to be the hard one – measuring the long-term impact of a 45 minute session on a group of 30 kids is bordering on the impossible.

The Sum of its Parts

Catherine Aldridge, Catalyst Learning and Communication, UK

Catherine Aldridge is the Director of Catalyst Learning and Communication. Previously she was Network Programme Director for the Science Learning Centres and Director of Exhibitions, Education and Programmes for At-Bristol.

We have seen the science communication community evolve to work together on larger scale projects and programmes. The question is: how can we make what we do greater than the sum of its parts to reach more people and build capacity within the field? What do we need to share and how should we do it?

The discussions that followed raised the following points:

Much effort is put into creating inspiring experiences and resources for our audiences but more effort could be made to reach audiences by working together and with others. This means using other existing networks and multipliers rather than trying to build audience bases alone. These organisations can act as brokers between those developing content and audiences for the content, and can provide ways in to those peer-to-peer and word-of-mouth recommendations that can be more valuable than marketing campaigns.

Another idea is to focus on seed projects where science communicators work with particular communities or groups. Innovative approaches to engaging people with science can be developed as well as embedding the practice with those groups so they can carry on using and adapting the 'product' without the science communicator's direct involvement. We need to relinquish control and let others make wider use of what is developed.

It would also help to identify 'big themes' for the community to work together on as this has been successful for Darwin 200 and the International Year of Astronomy.

Also, there is a sense that the wheel often gets reinvented unnecessarily. Before embarking on any new project, everyone should look at what is already out there and build on it rather than duplicate it. There are repositories of knowledge and real and online communities that can be used to do this, and of course search engines. There isn't a need to create new tools to share information, we just need to use the ones we already have more thoughtfully. A wiki set up specifically to share demonstrations had flourished briefly and then wasn't used – presumably because those using it didn't need it enough. We should, however, still experiment with making more resources open source, and letting each other know about it.

Public engagement needs a definition

Lesley Paterson, Royal Academy of Engineering, UK

Lesley Paterson is Head of Public Engagement at the Royal Academy of Engineering. Her work at the Academy is focused on building an infrastructure upon which public engagement with engineering can take place, in particular to encourage public dialogue on the impact of engineering on society and feed this into policy formation. Lesley has worked in public engagement with science, technology and engineering for over 10 years. Prior to the Academy, she was at the Wellcome Trust, where she managed science and society grant schemes and ran a programme of events to encourage networking and shared learning between public engagement practitioners. Lesley started life as a marine biologist wanting to work with dolphins and ended up slightly lower down the evolutionary scale with a PhD in worms.

Labelling a wide number of activities as 'public engagement' is often encouraged as it is seen to embrace diversity, but the result is the term has become far too vague to be of much use. The purpose, methodology and hoped-for outcomes of an extra-curricular schools activity to encourage key stage 3 pupils to choose science GCSEs is so wildly different from a citizens' jury to inform, for example, policy regarding the Human Fertilisation and Embryo Authority, it is difficult to see why the two come under the same umbrella.

The woolly nature of the term could actually be preventing progress. As the many players are moving in such different directions, only confusion arises when trying to move forward, as the original question has never been answered: what is it that public engagement is trying to achieve?

Science communication, behaviour change and legislation

Savita Custead, Bristol Natural History Consortium, UK

Savita Custead is the Director of the Bristol Natural History Consortium, a charity and collaboration of 11 high profile organisations working together to promote public interest and participation in natural history and environmental issues. Savita previously worked for ECSITE-UK, and has directed a range of science communication projects.

Climate Change is the greatest challenge facing humans – now or ever. No exaggeration. 2010 has been declared the International Year of Biodiversity, and the UN will demonstrate that every country has missed every target previously set in 2000. The news on species loss and habitat destruction is going to be apocalyptic. We now have an abundance of public engagement initiatives on climate change, environmental issues and nature. I know – I'll take credit…or blame…for some myself. What's the plan here exactly? Do we really think that we have the time left for more debate, more dialogue, and gradually 'encouraging' people to understand, and possibly take action? Could it be possible we have become so good at stimulating debate on science it actually prolongs how long it takes before people consider climate change seriously? Does democracy actually have a role here? And finally, what's the end goal – are we really going after the solutions, or just softening the blow for inevitable legislation?

Discussion

The agitators provided many thoughts for the delegates to consider, and their points were followed by a lively discussion around the pros and cons of defining public engagement, science communication and the plethora of other titles we use. Discussion around the definition of science communication led into questions about the role of science communicators as popularisers, brokers, formal educators, enablers, and/or policy informers, depending on each delegate's perspective. The concept of being a neutral broker was deemed invalid by some and the conflict between communicators' and funders' objectives was raised, where funders may want to promote science (or a particular scientific discipline) as a future career, while science communicators and indeed audiences have other motivations and needs. Participants stressed the importance of bringing cultural perspectives into science communication.

The discussion frequently returned to the issue of definition. For some participants defining terms was important because:

- There is a diversity of objectives hiding underneath terms such as science communication and public engagement, the process of definition would be enlightening;
- It would help us articulate what we do, how we measure it and how we share best practice;
- It would help us identify and communicate with our audiences;
- It would help us when we are liasing with stakeholders, funders and supporters.

However, others worried that by creating definitions the science communication field would split and cross-fertilisation of ideas would be lost.

Topics you may like to consider for further discussion:

- What does the future of science communication mean for you?
- Which motivations do you identify with as a science communicator?
- How would defining activities in the field more clearly support or constrain your work?

http://kcl.ac.uk/schools/sspp/education/staff/jdillon.html
www.gocatalyst.co.uk
www.raeng.org.uk
www.bnhc.org.uk
www.scu.uwe.ac.uk

Summary, Reflections and Next Steps

Frank Burnet, Science Communication Consulting, UK

Frank Burnet was invited to provide a final summary, reflections and outline of steps for the future at the close of the symposium.

Contributor: Frank Burnet,
Frank Burnet: Science Communication Consulting, UK

Chair: Clare Wilkinson, Science Communication Unit, UWE, Bristol, UK

Frank Burnet was the first Professor of Science Communication appointed in the UK and led the Science Communication Unit at UWE from its foundation. His core interest is in finding new ways of taking science to people, particularly hard-to-reach audiences. He founded and for five years co-directed the Cheltenham Science Festival and is now its International Director.

The Symposium covered a very wide range of topics and my challenge was to summarise and comment on what had been the key discussion topics and pointers to ways forward. It was a task that could only be done partially and I am certain that I missed many important issues.

I have put my comments under broad headings but many could appear in more than one.

The Role of Science Communicators

I detected some ambivalence to the idea that science communicators played the role of activists and might have personal political agendas. The delegates seemed to be more comfortable with the idea that any political role they might have arose when they briefed policy makers, which I would suggest is a motivation of only a minority.

The role of science communicators relative to scientists was not much mentioned and explored and there were a minority of delegates who found this frustrating. Some science communicators seem to view scientists as an impediment to science communication. In my view this is a mistake since the publics' view of science is very much derived from their view of scientists. To be provocative I would propose that the major role of science communicators should be creating circumstances in which the public have face to face encounters with scientists, particularly for work with adults. In other words as facilitators not performers.

Barnum and Bailey vs Billy Graham

Another topic which generated considerable discussion was whether or not commercialisation of science communication was appropriate. It seemed that for many it was uncomfortable to ask people to pay to experience an evangelist while for others selling tickets was an excellent way of discovering whether their event could cut it alongside other ways that people might elect to spend money on enjoying themselves. I would tend to side with the latter camp probably because I have attended many science communication events that would never have passed the test of competition with other forms of entertainment.

New Media vs Old

It was striking that the keynote speaker's invitation to think more about the role new media play in science communication was not taken up by delegates, except to make references to the use of the web. I was hoping that there would be greater interest in the use of the ever evolving hand held communication platforms to reach new audiences particularly young adults. Perhaps this could be returned to at a future symposium.

Practitioner led vs Audience led

It might just have been me but I felt I detected a continuation of the idea that the science communicator's job was to come up with amazing experiences that they believed would be useful to a particular (not always that well defined) audience rather than involving the target audience in every stage of the devising process for the event. An approach which my experience has shown is much more likely to produce a great event.

Another aspect of the professionalization of science communication given considerable attention was the extent to which the Science Communication community has matured so that it could reduce the extent to which it is a highly supportive self help group and become a profession in which criticism of each other's work was the norm. A topic that linked closely to the extent to which delegates thought it was useful to carry out evaluation of their work and share their report with others, including warts as well as beauty spots.

So that's the contribution from the grumpy old man. Hope it helps to progress the work of all who attended. It was one of those events that really deserved to be described as stimulating and eye opening.

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