

Evaluating European Public Awareness of Science Initiatives:

A review of the literature

Abstract

There are many public awareness of science initiatives (PASIs) and they are diverse, taking many forms from countrywide science weeks to small meetings focussed on a single issue, or perhaps a dramatised event. These represent a major investment of resources – individuals and organisations give their time, their expertise or may give material or financial support — and this resource intensiveness often extends to the members of the public involved. This paper will consider the extent to which these initiatives have succeeded. Feedback of this kind is invaluable for all those involved (or interested in involvement) in such enterprises, whether with a one-off activity or a long-term program. So how much evaluation is taking place, and what patterns does it reveal of the success of these initiatives? Work with the European Network of Science Communication Teachers (ENSCOT) has enabled a review of published items and the evidence collected to help paint this picture for European Union countries. From these initial findings it appears that many PASIs are not formally written up and still fewer are evaluated against their aims. The evidence also suggests differences between countries. This paper considers how evaluation could be used by all stakeholders to improve future initiatives in Europe and potentially further afield.

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Introduction

A broad and deep appreciation of the success of PASIs is important if we are going to improve on a chequered track record of increasing the public's awareness, appreciation and opinion of science (Miller S, 2001b). The political climate has changed across Europe (and beyond) and this means that there are now many groups with clear interests in raising the public awareness of science. The national importance of this is evident as several governments have set up national programmes for increasing science awareness, for instance; Germany is concentrating on dialogue with its Science in Dialogue initiative; Ireland has STI (Science Technology and Innovation Awareness Programme) aimed particularly at decision makers though encompasses everyone – this was a response to the Tierney report of 1996 (Duffy R et al., 2001). Whilst further afield, New Zealand has started a Science and Technology Promotion Program that encourages a positive culture to science; South Africa has its National System of Innovation, NSI, which is aimed at all citizens. (Gascoigne T, Metcalfe J, 2001).

Although there has been growing ambivalence to science in developed countries (Pardo R, Calvo F, 2002) highlighted in the 1996 Eurobarometer survey on Biotechnology, this need not be something to fear. It does however, represent a new phase for the various interrelationships linking science and society. The whole notion of the public awareness of science is something, therefore, that comes from an evolving pedagogy. Our societies are still far from the goal of a mature framework capable of enabling the successful negotiation of the issues to be faced in coming decades. Therefore, there is a constant need to review the way that science and technology are negotiated within society. Evaluation is a key tool supporting this. Though the success of PASIs will ultimately be revealed by the degree to which our societies manage to encourage this framework.

We have also been discovering that raising levels of knowledge does not directly lead to a more positively held attitude to science (Evans G, Durant J, 1995). This view is supported and developed by Pardo and Calvo . On this basis alone our engagement with the public on these issues would be informed by scrutiny and a discussion of the effectiveness of PASIs.

Method and Results

Evidence has been sourced through reports and other published documentation, also from some materials in production. Some items have yet to be formally published and will be available through ENSCOT in 2004. The evaluation of PASIs is a developing activity. The reporting of the successes of many initiatives is, sadly, anecdotal and so is of little use to this discussion. The European Community Research and Development Information Service

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(CORDIS) has recorded on its website the list of EU funded public awareness of science projects for 1999 and 2000 — there are twenty-seven¹. The coordinators of the 17 projects due to have finished at the time of writing were contacted by email with a request for a copy of any reports or reviews of their projects available for dissemination. Many of these have yet to reply, some individuals have clearly moved on and some further research is needed to identify the current contact, some replied to say there was no information available. Replies have been received from 9 and reports from 4.

The initiatives which yielded some evaluation details are listed below.

Da Vinci-Darwin-Linnaus — a set of activities to make connections between scientists, science teachers and students. European

Cracked — theatre. A play about teenage drug taking and bullying. UK

The people decide — Consensus conference on genetics testing and research. UK

K-Zone — a travelling exhibition on health issues for teenagers. UK

Eet es Genetisch in Ghent in Belgium — interactive exhibition on genetics organised by the Flanders Interuniversity Institute for Biotechnology in Belgium

VIB's biotechnology information pack — information pack building on *Eet es Genetisch*.

Visions of the future — British Association initiative, with collaboration from a number of organisations to raise and debate issues with teenagers. UK

Maths in Action — initiative to raise the general awareness within the population at large of the role of mathematics in everyday life. France

SET95 (The 1995 National Week of Science, Engineering and Technology in the UK)

Scientific Power to the People — Bristol University's staff set-up 40 stalls in a city shopping centre.

Models of the Universe — series of one-man talks held in Malvern Public library.

Young Inventors' Discovery Days — event held by Kew Bridge Steam Museum.

Health and Fitness in a Shopping Centre — a staffed stall in a shopping centre.

Working Under Pressure — open days at an aerosol company.

Flying High with British Aerospace — events for young people at British Aerospace.

¹ It is apparent this website is not entirely up-to-date, as there is no mention of *Inside the big black box* based at CERN

How to Launch a Teabag!— problem solving challenge for teams from schools.

Creating a Rain Forest in Northern Ireland— collaboration between organisations in NI for young school children.

SET96

Ketting General Hospital— open day at maternity unit.

CD-ROMS and Cocoa: the IT camp-in— an IT event for teenage girls.

Somerton Community Science Festival— a town science festival with many varied events.

Signals Across Cardiff Bay— collaboration between Technoquest and the Welsh Industrial and Maritime Museum.

It is important to note that reports can contain many general statements of success. These general statements cannot readily be used as evidence without being tied to the specific— whilst in the minds of the authors these points may well constitute definite indicators of success.

Taking a deliberate approach to evaluation allows very useful information to be gained. For instance the play *Cracked* was, it seems, a very powerful and informative piece of theatre, and as such could easily be shown to be effective from conversations with samples of the audience. However, the approach adopted took before and after questionnaires elicited much greater detail. It was shown that before seeing the play male students were more likely to identify external events as causal to mental illness e.g. drug taking and bullying. After seeing the play male students write more about sadness and loneliness.

The People Decide was a consensus conference held in London in March 1997. 425 members of the public who were selected to be a representative group took part with 43 observers. There were two sessions, the first took genetic testing as its subject and there were 6 votes after the presentations and debate. The second concentrated on genetics research and ended in four votes.

The method of evaluation used for this event is different to the others mentioned so far and it comprised recording and analysing the dynamics of the debates using methods familiar to social scientists. It also used telephone interviews, focus groups and an analysis of voting patterns. Perhaps a surprising outcome was that 99% of participants enjoyed the event. Less surprising was that opinions appeared to swing with the debate, and that this was particularly with the group of the most educated and articulate. This summary report also shows that recommendations were made to improve the effectiveness of such activities in the future. Thus the event was successful in meeting its aims though shortcomings, to do with getting a balance in audience composition and debate, were identified and suggestions made for reducing these (Evaluation Associates, 1998c).

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For the *K-Zone* interviews were the main source of feedback, and to be sensitive to the various audiences different constraints were imposed at each of the locations. For example clipboards were not used in the night club, and photographs were not taken at the doctor's surgery. At the youth club the evaluators felt the need to participate in the normal club activities prior to interviewing. Altogether the sample included observations of 269 people, and interviews with 41. (Evaluation Associates, 1998a).

The *Eet es Genetisch* initiative in Ghent, provided a visitors' book for individuals to record their comments and reactions to the exhibition. Comments were on the whole positive. (Moses PV, et al, 2002)

Discussion

My aim through this literature survey was to consider the aims of initiatives, the proposed method for implementing them, how well they were met and how this was established. The first observation that can be made is that although there really are very many PASIs taking place across Europe, only a tiny proportion are involved in any form of systematic evaluation and reporting on it. The next point I should make is that with the relatively low number providing sufficient material to study, we should not be looking to draw hard and fast conclusions or become involved in a discussion about percentages. In fact, of available published reports. Those of the SET weeks are the most informative and have all been produced by Evaluation Associates who have also written several of the other documents considered. Resulting in 15 reports from Evaluation Associates and 9 from other authors with sufficient detail to be included. There is a risk therefore that these findings might be to some extent weighted by the methods and approach of one company operating in this field and to the events taking place in one nation.

An objective in this context is an outcome that is planned, or that is hoped will happen if a conducive set of circumstances is arranged. This outcome must relate to raising the public awareness of science and technology. There are a considerable number of objectives identified in the reports though it should also be indicated that only three of the reports, *Cracked*, *K-Zone* and *CD-ROMS and Cocoa: the IT camp-in*, made statements of success that related to their listed aims

A list of some of the possible measurable objectives is; The number of high school students completing science courses; Science coverage in popular media; Movement in the salary levels of scientists and technologists; The number of scientists elected to Parliament; Changes in attitudes toward science measured at focus groups and by survey; The number of people enrolling in combined science-economics degrees; The number of high profile board members holding a BSc or BEng; The way scientists are depicted in popular films

and TV shows; The number of females graduating from universities with a BSc (Gascoigne T, Metcalfe J, 2001). This list differs from the vast majority of those stated in the individual reports largely because the objectives relate specifically to National programmes. Those involved in any individual initiative would find it near impossible to judge how they influenced any of these — they would be just one in any number of influences affecting people's judgements. In fact, the same could be said for the national programmes themselves.

To know whether a PASI has been successful we need to establish how well the objectives are met. There are a number of tools we have at our disposal. Gascoigne and Metcalfe list several which could be used in making summative or formative evaluations: focus groups ; unstructured interviews; questionnaires; surveys; opinion polls; observing behavioural change; analysing feedback; desktop analysis of newspaper clippings. (Gascoigne T, Metcalfe J, 2001). We can add the dynamics analysis of debate from *The People Decide*. Also, we can add polls which are commonly used in the case of referenda. There is a greater discussion on a smaller selection in (Boddington A, Coe T, 1996) This was produced for COPUS and is a good document to read if you are planning to get involved in a PASI and want more advice on evaluation.

To make evaluations of any measurable goals one needs to take (baseline) measurements prior to the initiative and compare the post initiative results with these. Gascoigne refers to 'So did it work' (Boddington A, Coe T, 1996) and notes the author's failure to mention this. Although he is correct and they omitted this important point we do see that they do later take this approach from their work cf. Evaluation Associates' report on *Cracked* (Evaluation Associates, 1997).

We see very few initiatives actually undertake any formal form of evaluation. Those that do (understandably) tend to opt for a questionnaire, interview or data analysis technique that gives an immediate indication of success. There may be pressure to do this from sponsors, and with very good reason as they need to be able to justify their expenditure. It would be wrong, however, to think that the only effect an initiative can have is that at the point of delivery. They are simply one of life's experiences which cumulatively help to form a person's opinions and views of their world. Long-term studies are therefore particularly problematic and I suggest almost impossible to consider for an individual initiative. There are some large scale activity that may help us gain details of the changing nature of the public awareness of science across Europe, in the shape of the Eurobarometer surveys, and these are raised elsewhere.

Event types

It helps to consider the range of the type of event. Evaluation Associates list the following types of event from their SET evaluations, talk, demonstration, competition, exhibition, open-day, workshop, arts event (Evaluation Associates, 1996). We should also add the public participation initiatives; consensus conferences, citizen juries, citizen panels, stakeholders' dialogue, focus groups, public hearings, referenda and scenario workshops (Thomas J, 2002). Also the *Da Vinci-Darwin-Linnaeus Initiative* had presentations, round table debates, workshops, poster sessions (these can either be part of an exhibit or an outcome from an initiative), discussions, theatre and other artistic performances. Also mentions live experiment and hands-on activities. (Pazzagli M, 2001; and Pazzagli M et al., 2001)

The different types of initiative tend to have different characteristics in terms of their strengths and weaknesses. The various public participation initiatives (PPIs) involve cross-sections of society in discussion and debate, and are particularly suitable for controversial and complex issues such as biotechnology and genetically modified food. They enable individuals to engage with the science and are an expression of the dialogue that is developing between science and society, and are successful at informing and enabling participants to assimilate this information. The democratic process is fundamental to these and they in turn support a greater openness between experts, decision-makers and the public. There are difficulties associated with them. One is in ensuring the groups taking part are as representative as possible of society and another is that some participants are not confident in involving themselves in the initiative, for example in debates which can be dominated by a very small number of (frequently male) contributors. These are an important way to confront ambivalence enabling people to get off the fence. It was noted in the report on *The People Decide* that opinion appears to shift with debate, and this is not surprising as people are trying to make sense of the information they have been given on complex issues. They will hear an explanation or statement that persuades them to get down on one side of the fence, only a minute later to hear another that makes them lean towards the other. The overall success of these initiatives depends on whether the public perceive that they are really used to help shape policy. The reports on the UK conferences make it clear the government is not intending to incorporate them into policy-making structures. In contrast Denmark, the Netherlands, and Switzerland have a history public participation in decision-making about scientific and technological issues and do act on the results.

Attendance and popularity

Getting people to attend an event is not simply enough. It is possible to fill a hall to capacity but if these people are already interested and knowledgeable, does this really help to increase the public awareness of science? Alternatively, it is possible to draw in entirely members of the non-attentive public but how do you ensure they leave with a raised awareness and appreciation of science? These questions are central to the idea of a successful event. It would be churlish to suggest there is no value in providing an event for the interested or that it is not successful in many ways. It simply does not make a great impact on raising public awareness. This report considers a very narrow definition of success by only considering it to relate to the raising of public awareness of science engineering and technology.

Attendance figures alone are, therefore, an insufficient measure of success though are useful indicators.

It is possible to equate success with popularity, and perhaps, the excitement generated. However, caution should be used as giving people a good time (entertaining them) does not mean that their awareness or appreciation of things scientific or technological has been raised. *Flying High with British Aerospace* is an example of this, at least from the report, which suggests the aims were not clearly identified at the outset, and that the organiser thought them successful simply because the children had a good time — I suspect more was actually going on however, even though it was not included in the report. Enjoyment is important as a person is hardly likely to gain in understanding or appreciation if they are not involved and enjoying the activity.

Goal setting

It is relatively easy to set down a series of desirable goals for any particular project but it is harder to define a set of measurable targets. If there is really to be constructive feedback on the activity there must be some method for judging the degree to which it is successful. Planning to make an assessment is an important step in itself, as it requires resources that could perhaps be used for the project.

The setting of goals frequently appears to be omitted, or at least not stated publicly. A useful reminder when goal setting is the idea of SMART (simple, measurable, achievable, realistic, timebound) (Gascoigne T, Metcalfe J, 2001, though ubiquitous in management training). These are not independent factors but do illustrate different important facets of an effective set of objectives. The objectives need to be simple, clearly stated to allow for no ambiguity or confusion. To enable everyone to understand and share them. They should be

measurable in order to allow the degree to which they have been met to be established.

Without this, success can not be demonstrated. Achievable shows that it must be possible to meet the objectives within the terms of the initiative, if not, one should question whether it should go ahead. Not only should the aims be possible but they should be likely – there should be a high probability of success. The aims should not be left open-ended and the organisers should have an expectation as to when they should be met and so they are timebound.

We have seen there are often other goals in addition to those of raising public awareness of science. These might be to do with improving community links or relationships with certain groups of people. *Working Under Pressure* had this effect, whether or not it was planned. Or they could be concerned with raising the morale, energy, or productivity of an organisation. Several have reported this kind of effect: *Scientific Power to the People*; *Working Under Pressure*, and *Somerton Community Science Festival*. One, *The Kettering General Hospital*, notably found it was likely to lead to the opposite effect. There could conceivably be economic ambitions. This, though not stated, could be one of the *Somerton Community Science Festival*'s. Within the region of half (if numbers responding to the questionnaire could be taken as representative of all those visiting) the visitors coming from outside the area, one would expect many local businesses to gain from the event.

So, whilst this initiative failed in terms of meeting its aims, the organiser did not feel completely disappointed as there were several very positive outcomes. The effect of not meeting aims is perhaps likely to lower their willingness to become involved in another event however.

The vast majority of the statements of success given throughout the literature are both qualitative and immediate. They reflect individuals' response to an initiative at the time it occurred and relate their feelings and opinions towards it. The most common qualitative statements given have been to do with attendance numbers, and these can be used (with care) as an indicator. The evaluations of *Cracked*, and *The people decide* notably used numerical data from an analysis of pre and post event questionnaires in the case of the former and an analysis of the dynamics of the debate in the latter.

The relative lack of evaluation taking place is possibly a reflection of the youthfulness of this area of activity. Although it is clear that evaluation is becoming much more important to those organising, or funding PASIs. There are signs that it is becoming more formalised and involves broader groups of people spread over a greater geographical and institutional range. The centralisation of funding with many EU initiatives supported directly by the EC also encourages this.

Conclusion

This study shows that a discussion of the effectiveness of PASIs is dependent on their evaluation. Also, that in Europe (at least) very little of this is currently carried out and reported publicly. It is understood there are very good reasons for this but also that its requirement cannot be overlooked if we are to become better informed about the nature of the interrelationships involved and the social changes affecting them, and most importantly for more successful communication. Existing reports are often very informative. However, so many include such generalised descriptions and phrases without substantiation to the exclusion of clear evidence that these cannot make a firm contribution to this discussion. Also, we see very encouraging and positive statements of achievement. For example, several times the raising of morale or of teambuilding within the groups involved in the organising and staging of events is described. However these, and others, were never mentioned amongst the aims at the outset, and although they are very valuable outcomes these cannot be considered as primary aims of any PASI.

One recommendation would be to urge all groups organising PASIs to endeavour to include some degree of systematic evaluation and reporting, and to plan for this from the start. We should encourage, as good practice, the clear setting down of aims, the routes to achieving them and a plan for the deliberate attempt to judge whether these were met. There are many possible variations and these lead every single PASI to be unique in some way. It is very important to clearly define the particular group that is intended to participate in the PASI and whether it is intended to take the science to the people or to bring the people to the science. To reach the broadest cross-section of the public one would undoubtedly, in the UK set up a stall in a busy shopping centre. In Barcelona, for most of the year one would choose a city square, and another location still would be appropriate in other regions.

Cost (including financial, resource and time) is naturally a major element influencing whether evaluation can take place, and what degree of evaluation is possible, if it does take place. Interviews and questionnaires can be relatively low cost and do yield useful information and thorough evaluation is expensive. Although no specific details of the cost of evaluation have been detailed in the texts it is likely to be a significant proportion of the funding most PASIs, and is dependent on the tool used. Yet the importance of evaluation cannot be denied if we are really to assess the effect of initiatives.

It would greatly help if funding bodies identify some proportion of funding for evaluation purposes and Science Week organisers give increased support and advice to encourage this. To gain a more coherent picture however it would also be a positive step to make larger and more long-term surveys, perhaps this could be achieved with more focussed questions in the Eurobarometer surveys. As they stand, they have been criticised as an insufficient tool

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(Pardo R, Calvo F, 2002). More research could be encouraged in this area which would itself generate a reliable body of knowledge.

It is important to remember that attendance figures (or of numbers interacting) are not in themselves measures of success but are better considered as partial measures of the opportunity for success in raising awareness.

We should also not forget the warning given in (Moses PV, et al, 2002) that it has been learned from experience that organisations regularly assume an approach successfully applied in one culture can gain the same success if simply applied in another.

A discussion of effectiveness and success cannot take place without the accompanying issues of goal setting and evaluation. Further, that none of this is even possible without a report. So many initiatives do not produce reports, and for very good reasons. It is clear from the material available that so many initiatives, particularly in Science Weeks are organised and staffed by 'volunteers' with already full workloads. It is already asking a lot of these people for the events simply to be staged. To ask them to also put resources into evaluation is just out of the question. However, with the encouragement endorsed above, this may slowly change, and individual organisers may also find their work more rewarding if a degree of feedback and the possibility for reflection is incorporated.

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