Title of paper
Why do governments spend money on national programs of science awareness?

Abstract

Most countries have national programs to increase the public awareness and understanding of science. The assumption behind the programs is that a scientifically-literate population will ultimately lead to healthy and economically prosperous country.

How do we know if these programs achieve their aims? Are they evaluated, and if so, what methods are used?

The paper looks at the way the Australian Science and Technology Awareness Program has been evaluated, and comments on the limitations of the methods used. We propose a simple five point model for evaluation.

Our conclusion is that the credibility of programs designed to lift PCST will be undermined unless science communicators devote more resources to evaluation.

Introduction

Many countries round the world support programs to increase the public awareness of science and technology. These programs have specific aims and objectives, because governments like to know how and why their money is being spent.

While there may be a difference in emphasis between national programs (between understanding and awareness and communication), the reasoning behind most of them runs like this:

- We want a modern, knowledge-based economy
- Only this sort of economy will deliver the satisfying, high-pay, sustainable jobs that will ensure our national prosperity
- We believe it would assist us to achieve this sort of economy if we had a population which understands and appreciates science
- We need a population which understands health and safety issues, like AIDS
- We also want to ensure the next generation of scientists and technologists, and to stimulate students to do science at school and university, particularly in the "hard" sciences like mathematics, physics and chemistry
- Therefore we will run projects to bring science to people and show them how relevant and interesting and important it is

These projects may include science shows, solar boat races, open days at research organisations, funding new programs on radio and TV, giving prizes for outstanding media coverage of science, stimulating new educational materials, and running educational programs to deal with particular issues in special target groups.

Quite often the national programs have special target groups. The South African program, for instance, targets learners , educators, women, youth and the disabled; while the Irish program targets "decision-makers in the public and private sectors and also at the education and business sectors, the media and the general public." This emphasis on economic outcomes is common, although they can include social or environmental aims.

Do we know whether these programs work? Are their objectives ever tested? If people running programs in the public communication of science and technology, or science awareness, or the public understanding of science - I'm not going to distinguish between them - want to evaluate their programs, what steps do they need to take?

Before I continue, let me explain the driving force behind this paper. There was an informal meeting of the Scientific Committee of the PCST group in Budapest, at the World Science Congress in 1998. We discussed this conference, and how it should be organised, and what issues should be addressed.

The issue of evaluation was tentatively raised, and immediately accepted. It was recognised that current evaluation processes are a weakness in many programs and projects designed to lift PCST. While inadequate evaluation is a weakness, it undermines the credibility of much of what we do in these programs.

Evaluation is a key issue. The governments and organisations which fund these programs can quite rightly ask: are they working? Our community of science communicators would be well served if the assumptions on which PCST programs sit were tested.

Today, I want to do three things:

One, to list some of the considerations that an evaluation process should follow

Two, to describe the Australian program on PCST, the Science and Technology Awareness Program (STAP), together with a brief look at examples of similar programs in other countries

Three, to examine a number of evaluations involving STAP.

1. Some of the considerations that an evaluation process should follow

a. Evaluation should be built into a program from the start. Objectives of the program should follow the SMART rule - simple, measurable, achievable, realistic, timebound. The difficulty with many of the national programs is that their objectives are anything but SMART. They tend to be CUT - complex, unmeasurable, and lacking timeliness.

The objective of Australia's STAP, for instance, is: "to develop a greater understanding in the wider Australian community of the important roles played by science, technology and innovation in all aspects of our life, and particularly in economic and social development."

This is more like a mission statement than an objective, and it needs to be fleshed out with a series of operational statements setting out what the program is going to do in simple measurable terms. Measurable criteria will enable us to assess the effectiveness of the program. These measures (or some may call them performance indicators) could include, for instance:

- 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

So if school and university science courses were overwhelmed with new enrolments, if salary levels for scientists shot upward, if scientists were treated with dignity and respect on popular TV, if the circulation figures for science magazines doubled, and if many scientists were elected to Parliament, we could say our program of national awareness was working!

It is important here to acknowledge that the link between cause and effect can be notoriously hard to demonstrate in these areas. How do we know our program caused a certain effect? The activities of national programs like STAP are complemented by the work of science centres, museums and educational organisations, so other events are happening at the same time - for instance, the number of new technology start-up companies may suddenly increase after you have run a business awareness program. What influence has your awareness program had, compared to a change in the tax rate that made this sort of investment much more attractive, or a series of seminars run by the university?

b. A second consideration in evaluation is having baseline data. If the program is to be successful, we need to be able to detect a change. To see the change, we have to establish baseline data - a measure of where the population is now. Then the new program is run, and at the end any changes in attitudes or behaviour can be measured against this previously established baseline.

An example of baseline data for a project designed to build awareness of career opportunities for women in science would be to collect statistics on the number of female students enrolled in science courses before the awareness project commences. Then data is collected again after the project has run, to measure any changes.

There are other matters to be considered in working out the best way to evaluate a program. The process may take a summative approach, which depends on matching the objectives of the program with its outcomes. In this case, the question to ask is: did the project meet its objectives? You have to compare the "before" picture with the "after" picture, to assess whether your program changed anything.

Or it may be appropriate to take a formative approach, in which the program can be modified and improved while it is under way. This overcomes the difficulty of having to wait until the end of the program before carrying out evaluation, as one must under a summative assessment process. This is largely a matter of building in monitoring and tracking mechanisms prior to commencement.

Here is a string of assessment tools 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

This is not a complete list, and this paper is not an exhaustive discussion on the intricacies of evaluation. Material on this subject is readily available. One simple discussion on science events is by Boddington and Coe,"So did it work?", http://www.royalsoc.ac.uk/scforall/copusSodiditwork.pdf.

(Although disappointingly it omits any references to establishing baseline data.)

What I want to turn to now is a simple model for evaluation which could be used in the sorts of programs or projects which aim to change or influence public views on science and technology.

We suggest a five step process:

1. Identify clear objectives for the program or project, for example to increase the awareness of high schools students in career opportunities in science. This project could have as a performance indicator the students' level of awareness about science career options.

2. Identify the audience you want to influence, and then establish baseline data. For the example of high schools students, this could be to measure the current awareness of students before implementation of the awareness project.

3. Identify the most appropriate method to assess changes, by choosing from the range of assessment tools listed earlier. Using our school example you might conduct a telephone interview with a representative sample of students.

4. Carry out ongoing assessment during a project, to shape it. The aim is to improve effectiveness, and save time and money. In the school example again, you may discover that the photographs of scientists used in the project reinforce negative images, and so the material needs to be revised. You can do this while the project progresses.

5. Carry out post-project assessment, again by choosing from the possible tools listed earlier.

A similar model is proposed in a booklet published by the International public Relations Association, "Public Relations Evaluation: Professional Accountability" Gold Paper No. 11 November 1994.

2. Programs to boost the national awareness of science

Australia

Australia established a national program to increase the public understanding of science and technology issues in 1989, the Science and Technology Awareness Program (STAP).

The aim of STAP was "to develop a greater understanding in the wider Australian community of the important roles played by science, technology and innovation in all aspects of our life, and particularly in economic and social development."

The STAP website expands on this statement to explain the thinking behind the Program. The language and reasoning is essentially couched in economic terms, and will be familiar to any of you who have looked at national programs in other countries:

"Society depends more and more on science and technology to supply knowledge and information, to find answers to new and pressing problems and to help maintain the high standard of living we now enjoy. A community which is informed about, and at ease with the subject, is better able to debate and make informed decisions on science and technology issues. Science and technology can give our industries a competitive edge. They help us pursue sustainable development which is ecologically friendly and also improves our economic and social well being." (STAP website)

What does STAP do, and what sort of budget does it have? From the STAP website, we learn that it:

- runs the Prime Minister's annual science prize
- sponsors awards for science journalists
- administers small grants for individual science awareness-raising projects
- participates in and partially funds National Science Week
- publishes a newsletter, and maintains a register of science communicators
- periodically assesses Australians' attitudes to and understanding of science and technology, and
- counts media coverage of science

STAP has a modest budget of about $US 1.5 million per year to run these activities, funding which is leveraged through partnerships with organisations such as science museums. It aims to reach in particular five target audiences:
young people and their teachers
women
industry and business leaders
scientists, technologists and engineers
journalists and other media practitioners

Before talking about the way STAP was evaluated in 1999, I want to look briefly at the position in some other countries in the world.

Ireland has the Science Technology and Innovation (STI) Awareness Program with the overall theme of "Science for a Successful Ireland". The Program was established in response to the Tierney report of 1996, which called for:

"… a new vision of innovation in Ireland which will provide the motivation for enterprises, individuals and the public sector ... Paramount to this vision is a change in our cultural approach to risk-taking and the need for a long-term view…"

The Irish Government has targeted the Program "particularly at decision-makers in the public and private sectors and also at the education and business sectors, the media and the general public."

South Africa has established National System of Innovation (NSI). "For [the NSI] to be successful it requires that 'All South Africans should participate … It requires a society that understands and values science, engineering and technology ..... thereby ensuring national prosperity and [a] sustainable environment'."

Germany
In May 1999 the leading organisations of sciences, upon the initiative of the 'Donors Association for the Promotion of Sciences and Humanity in Germany' decided to lead the dialogue with all groups of society.

The result is "Science in Dialogue", a nationwide initiative. It aims to open a dialogue with all members of society, provide information about methods and processes of research; and highlight mutual dependency of science, economy and society.

New Zealand has a Science and Technology Promotion Program to generate a culture that understands and supports science and technology as integral to the country's future prosperity and well-being.

The program wants New Zealanders "to better appreciate the positive role science and technology can play in the economic, social and environmental well-being of their country, themselves and their communities; and to embrace science and technology as pivotal in a knowledge-based society, and essential to the creation of a desirable future."

Great Britain
The British Association for the Advancement of Science "works throughout the UK to promote understanding and development of science, engineering and technology, and to illuminate and enhance their contributions to cultural, economic and social life."

From this quick web survey of other national programs that aim to raise the public understanding of science, there is a recurring theme: countries invest in public awareness of science campaigns because they want to lift their economic position.

3. The question remains: do PCST national programs work?

I will look at the Australian program in this context. STAP has been involved in a number of reviews by external consultants to assess its effectiveness and shape its strategy. What methods did the consultants use? What conclusions did they come to?

The 1999 Review was commissioned to:
1. review the effectiveness of STAP
2. identify the science and technology awareness needs and the extent to which these are being met by the current programs
3. recommend any changes in the programs necessary to meet current and future objectives.

In their report, the consultants give some guide to their methodology:

"This 1999 review of the STAP program has involved extensive consultations with key stakeholders, review of existing materials, programs and research; assessment of other relevant government programs; development of options for reform of existing STAP programs; and identification of possible new programs…

"As part of this review of STAP, Buchan [the consultants] consulted with a wide range of stakeholders and received a number of written submissions."

These consultations involved meetings with individuals and groups across Australia. These people included the Chief Scientist; the Science Minister's office; organisers of events such as National Science Week and the Science Olympiads; the Australian Broadcasting Corporation (responsible for almost all TV and radio science shows); bureaucrats; museum personnel; and groups from business and industry. The consultants met major grant recipients, and reviewed program reports.

There were also 23 written submissions from bodies including the Australian Academy of Science, the Federation of Australian Scientific and Technological Societies, the Science Teachers' Association, the Australian Science Festival and the Australian Museum. Buchan reviewed reports on existing projects and questioned major grant recipients

Further components were a limited survey of other science awareness activities in other programs carried out by Australian governments at federal and regional level; and similar activities in the EEU and eight other countries.

The consultants were generally positive:

"The STAP program has produced some outstanding successes. Our consultations have revealed consistently positive feedback on major elements of the STAP program, and our analysis shows that these programs have produced significant awareness outcomes." (p IX)

The consultants suggested a new approach, saying that times had changed over the eleven year life of the Program and that STAP needed to focus more on coordination, collaboration and communication. There should be less emphasis on micro-management, and more on developing strategic partnerships to boost funding and program effectiveness. They identified major priorities, recommended a new structure for programs, and suggested an expansion of funding.

They said that STAP provided the Government with an opportunity for national leadership, and "a potential platform to drive the government's policy agenda in the pursuit of a more innovative economy." (p XII)

It noted there are "important issues regarding science awareness that go beyond the terms of reference for this Review", and suggested these matters be explored by the Prime Minister's Science Council. This was tacit recognition that the review would not be able to deal with all the issues connected with a review of STAP.

In 1991, 1994, 1997 and 1998, Woolcott Research was commissioned by STAP to review progress. The four reviews they carried out had a similar objective and similar methodology.

The objective of the 1994 Review was typical:

"To undertake an assessment of contemporary Australian attitudes to science and technology, to analyse these in the context of past research and the goals of the Awareness Program, and to make recommendations for its future strategy."

Their methodology had both qualitative and quantitative elements, and they gathered their information through group discussions, telephone interviews, individual in-depth interviews, and random surveys of citizens over the age of 14.

The Woolcott reviews have enabled the Government to track changes in Australian attitudes on questions such as:

- The perceived importance of science and technology in everyday life
- The importance of science and technology in Australia's economic future
- The reward of careers for young people studying science and technology
- The suitability of careers and study for women in science and technology

So - how useful are reviews by Buchan and Woolcott?

Buchan gives us a good picture of how the science community views STAP. Almost without exception, everyone involved in responding to the review was a scientist, or worked for a science organisation, or in science communication. It examined in some detail questions such as:

- Did the science community approve of the STAP projects?
- Was STAP an efficient delivery vehicle for converting government funding into science communication projects?
- Was the level of funding adequate?
- What was the target audience, and how many people were reached?

Not surprisingly the science community quite liked the projects but wanted a change in the balance of funding; had various opinions on the efficiency of STAP as a funding mechanism; and considered STAP should be given more money to fund more programs the science community wanted.

The Buchan Review did not assess whether Australian attitudes to science and technology were changing, or whether the activities promoted by STAP were responsible for any changes in attitude. (It should be noted that budgetary constraints did not allow them to commission new research.)

The Woolcott reviews do measure changes in Australian attitudes to science and technology, but not whether STAP caused these.

There is value in both the Buchan and Woolcott Reviews, and both contribute to an overall picture of science awareness and attitudes in Australia.

But because neither established a link between the activities supported and funded by STAP, and changes in Australian attitudes to and understanding of science, we still do not know if STAP has caused Australians to become more or less aware of science and technology, or of the part science plays in stimulating economic and social development.

4. Conclusion

Before turning to my conclusion, I wish to acknowledge the assistance of Adelle Grivas who suggested material and read critically drafts of this paper; and Michelle Riedlinger, who collected useful information on international aspects of this issue.

My colleague and co-author Jenni Metcalfe and I are grateful for the assistance they provided in bringing this paper together.

I would like to remind you that the issues raised in this paper will be explored in the accompanying Workshop 3 this afternoon. They will describe national and

international programs in Thailand, South Africa and Poland, as well as an international program on a health issue. Evaluation will be a major point in these talks. The workshop may like to make recommendations on future work in this area, possibly as a theme for regional conferences.

The key point from this paper is that, as a group, we need to introduce a little more science into our work. Evaluation is not a simple task, and it can be both complex and expensive. It needs to be considered from the time a project is conceived, and to be carried out in a methodical and considered manner. The value of evaluation will often not be apparent until after the project is completed; but where it is a weakness, it undermines the credibility of programs designed to lift PCST.

If I were a Minister for Science responsible for funding a PCST program, I would be seeking hard evidence that it had some effect on the general population. This would include testing the assumed link between a scientifically-literate population, and a prosperous community.

And if I were a science communicator depending on this sort of funding, I would be establishing some operational objectives to expand on the broad mission statement. Then I would start measuring things, so I knew whether it made any difference.

In an interview with Science magazine on December 6 last year, President Bill Clinton said: "I think the language of science--and the necessity of understanding at least the basic concepts of science--will become a much more pervasive part of the average citizen's life in the next 20 to 30 years than it ever has been."

If we as a group believe that, it is incumbent on us to be able to demonstrate why it is important.

Thank you.

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