



So did it work?

Evaluating public understanding of science events

More and more people and organisations are becoming involved in raising public understanding of science. There are now events for the public most days of the year as well as designated days, weeks or years. But is it worth all the time and effort? This guide will help organisers answer this question through evaluation of their events.

Why Evaluate?

Formally, evaluation is the rigorous, independent analysis of ongoing or completed activities. A more practical definition is that it is an effective way of learning how to do things better. Many organisations, particularly in the public and voluntary sectors, are turning to evaluation as a source of learning and to justify their use of funds. For organisers of public understanding of science events, evaluation has four main benefits:

- preparing for the evaluation can help you and your colleagues crystallise ideas about the event and what it is intending to achieve

- it provides information on the outcomes of an event, along with suggestions for improvement

- finding out who has attended your event, along with suggestions for improvement.

- the results can provide encouragement by demonstrating that your efforts have been worthwhile.

Evaluation can be time consuming and costly. In this guide we provide advice on how you can conduct useful, parsimonious evaluations of public understanding of science events.

What to Evaluate?

The first stage is clearly to define what the event intends to achieve. You should answer the following questions when planning your event:

- 1 **Audiences.** Which are the intended audiences (for example: children and their parents, members of the public currently uninterested in science)?
- 2 **Numbers.** How large an audience do you expect (with expected numbers for each category of audience)?
- 3 **Experiences.** What will be their experience at the event (for example: fun and excitement, teamwork, problem-solving)?
- 4 **Education.** What will they learn about science at the event (for example: understanding of principles, specific facts, contribution of science to well-being)?
- 5 **Attitudes.** Do you expect your audience's attitudes to science to be changed by the event (for example: stronger support for science or more informed decision making)?
- 6 **Follow-up.** What do you expect your audiences to do after the event (for example: join a scientific society, do projects in the classroom or at home)?

Your evaluation should address each of these questions, but concentrate on those which are of most importance to you. You may also have formal objectives for the event (for example: to increase the public's awareness of your institution and work). These can be used in addition to the questions above when designing the evaluation.

How to Evaluate?

There are three main evaluation methods for obtaining the views of participants:

Questionnaires. These are usually distributed to people as they arrive or leave an event, though postal surveys may occasionally be appropriate. Questionnaires are the best method of collecting a large volume of quantitative data.

Interviews. Most often these will be 'exit' interviews of people leaving events. They are the best method of obtaining information about people's experiences and opinions.

Focus groups. These bring together organisers and participants to discuss their experiences at the event. Focus groups collect less specific data than questionnaires or interviews but can generate useful ideas for future events and can help reinforce messages and learning from the event. They can also allow you to pursue particular issues in greater depth.

Your evaluation might use any combination of these methods. In addition to these methods, there is a fourth useful method: counting the number of people that attend! Attendance statistics will not tell you whether your event is successful, but if no-one comes it certainly will not succeed!

Designing Questionnaires

Principles

Questionnaires are most useful when you have a 'captive' audience, such as in a talk or - for postal questionnaires - when you have a list of names and addresses. They are excellent at collecting quantitative data. Distribution and analysis of quite large numbers

of questionnaires can be relatively cheap. There are four key principles to keep in mind when designing questionnaires:

- Clarity:** ensure the questions are understandable
- Brevity:** keep the questionnaire short
- Simplicity:** provide multiple choice answers wherever possible
- Neutrality:** always phrase questions neutrally.

We explore these four principles below and provide advice on question order, questionnaire layout and sampling.

Clarity

When phrasing a question remember that you probably know a great deal about the event and you may have a high degree of scientific or technical knowledge.

Always:

- ask yourself whether the intended audience will fully understand the question
- keep the questions short.

Never:

- use jargon (such as "public understanding of science") and if you must use it, explain it!
- ask two questions in one (for example: "how much did you enjoy the event and will you come again?")

Brevity

The questionnaire must be short. Most questionnaires get longer with redrafting. There is no perfect length for a questionnaire but the shorter it is the higher the response rate will be. Short questionnaires are also easier to analyse!

Always:

- ask the question "are the responses to this question going to be useful to us, or just interesting?", then cut out all questions that are merely interesting
- try to limit your questionnaire to two sides of A4 - one would be better!

Simplicity

Phrase your questions simply

Always:

- ask questions in a logical sequence
- use multiple response questions with tick boxes wherever possible especially where the only possible answers are "yes", "no", and "not sure".

Car
Coach
Train
Bicycle
Walked

Other: please specify *My hot air balloon crash landed!*

On multiple-choice questions about attitudes and experiences, you will need to decide whether to use a two or four point scale (in addition to an option for 'not sure' or 'don't know'):

Yes
No
Not sure

Or:

Very enjoyable
Quite enjoyable
Not very enjoyable
Not at all enjoyable
Not sure

The two point scale is simpler but may lead to more 'not sure' responses if people do not have strongly positive or negative experiences at your event. It is important not to force your respondents to answer one way or the other. If you get a high number of "not sure" responses, it is either because your respondents are genuinely uncertain or because they do not understand the question!

Neutrality

Even though you will be an enthusiast for the subject covered by your event and even though you may desperately hope that it shows your efforts in a good light, your questions must be neutral! This means that they should not lead the respondent towards any favoured answer.

Genetic engineering is beneficial for people and society. Do you agree with the statement?

Yes
No
Not sure

This phrasing may result in a bias towards positive responses as it firmly states a 'truth' that respondents may be reluctant to deny. A better way of phrasing the question would be:

Could you tell us your views on the contribution of genetic engineering to people and society? Do you believe it to be:

Strongly beneficial
Beneficial
Not very beneficial

Not at all beneficial

Not sure

This neutrally presents a range of options. Again, always allow the option of "not sure" in multiple choice questions.

Question Order

The following guidelines will help you decide in which order to place questions:

- **Engage interest.** You need to capture respondents' interest so that they concentrate on the answers to your questionnaire. Where the event may be of only passing interest to the respondent, start with specific questions then open out to broader issues (for example: begin with particular aspects of an exhibition and move on to concerns about genetic engineering). Do the reverse when the topic is of particular interest to the respondent (for example: ask people leaving a talk on genetic engineering their views on its benefits and later on narrow down to issues, such as the quality of the presentation).
- **Logical order.** Arrange questions in a logical order and group them into sections. Always introduce each section to allow the respondents to change mental gear (for example: "We would now like to ask a few questions about yourself so that we can learn more about the range of people that come to our events").
- **Sensitive questions.** Some questions (for example: about age or income) can be quite sensitive. They can alienate the respondent if these are at the beginning of the questionnaire: place them at the end.
- **Skip rules.** Try to avoid skip rules (for example: "If you answered Yes to this Question go to Question 8"). Too many skip rules can introduce confusion and make questionnaires harder to complete.

Questionnaire Layout

The following guidelines will help you design the format of your questionnaires:

- **Introduction.** Always include an introduction that explains the purpose of the questionnaire and how you will use the data. Even if you include this information in a covering letter always repeat it on the questionnaire. For postal surveys, this also applies to the return address: people often discard or lose the letter before completing the questionnaire!
- **Layout.** Always try and design a professional looking attractive questionnaire. Avoid clutter and provide clear instructions for completion. Never crowd questions together or use small typefaces to save space.
- **Easy to complete.** Make sure your check boxes are large enough for a good size tick. Allow sufficient space for written answers so that the respondent does not have to compress their writing.
- **Number questions.** Always number questions. This will help you with analysis.
- **Ask for comments.** Consider asking for general comments at the end (for example: "Please write any other comments you have in the space below.") This

will capture points that matter to the respondent but which you do not cover in your questionnaire.

Finally, always pilot your questionnaire wherever possible. Even quite obvious flaws are easy to miss and might lead to biased or erroneous answers.

Sampling

You will need to take a pragmatic approach to sampling. Too few responses may mean that your data is not representative and could reduce the credibility of the evaluation. If you receive too many responses you may not have time to analyse them all! Think firstly about the likely response rate. For postal surveys expect a response rate as low as 30%. Talk audiences might provide a 60% or better response rate, while that from exhibitions may be less than 15%. For events that attract up to a few hundred people, try to survey everyone. For larger events, you may need to sample to keep costs down. The best way is to survey every *n*th person (for example: by handing out a questionnaire to every fourth person who enters an exhibition or placing a questionnaire on every fourth seat). It is surprisingly easy to introduce bias if you do not stick to a formal sampling method. People who pick up a questionnaire from a pile, for example, may be more motivated and more likely to have positive impressions about the event.

Interviews

Fun but Tiring

Interviews are fun as they allow you to "meet the punter." They can also be quite tiring and always require considerable concentration and discipline. All the caveats and advice for questionnaires apply to interviews. A basic decision is whether you wish to conduct telephone or face-to-face interviews. For public understanding of science events, face-to-face interviews will most often be 'exit' interviews with people leaving events

Always:

- base your interview on a questionnaire (known as a 'schedule') which is completed during the interview
- brief the interviewers well and ensure that they fully understand how to ask each question and record answers from it
- practice asking the questions, either on a colleague or another interviewer
- debrief the interviewers: this will provide you with feedback on your interview schedule, early impressions about the success of the event, and will suggest potential issues to be covered in the evaluation report.

Differences Between Interviews and Questionnaires

There are many similarities between questionnaires and interview schedules. Nevertheless, schedules must take account of the different context. In our example interview schedule, for example, we ask much the same questions as in our example questionnaire. We have, however, reduced the number of repetitive questions to avoid losing the interest of the subject. Questions 2-7 in the questionnaire have become questions 2-5 in the schedule, with questions 3 and 5 seeking open responses about the interviewees' experiences. We also ask Question 1 differently. Rather than present a list of four options (plus 'not sure'), the interviewer first asks whether the interviewee enjoyed the Discovery Day. The 'yes' or 'no' response is then refined (unless 'not sure' is recorded). If, however, the interviewee answers "er... maybe", it would be appropriate for

the interviewer to immediately ask "was it 'enjoyable' or 'not very enjoyable'", recording 'not sure' if the interviewee continues to hesitate. With interview schedules

Always:

- **ask simple questions:** follow a similar approach to questionnaires: keep it short and keep it simple

Never:

- **use long lists:** asking people to select one of more than four options can tax their concentration and create a positive bias towards the later options.

Good Interviewing

Good interviewing depends upon a personable but proficient demeanour and a well-structured approach

Always:

- **identify yourself:** wear a special Tea-shirt or hat and a name badge to identify yourself and your purpose and approach children only through their parents or teachers (particularly in places where the public have free or easy access such as university campuses and shopping centres)
- **gain confidence:** introduce yourself and tell people how answering questions will help you
- **record answers immediately:** never allow the pressures of an interview (for example: people wanting to get away) to distract you from writing down answers to each question immediately.

Never:

- **lead the respondent one way or the other:** if people are not sure, they are not sure!

Sampling

With exit interviews, sampling often involves no more than deciding how many people to interview and then continuing until you reach that number. If you are interviewing at an exhibition, you should spread your interviews throughout the exhibition to ensure representative coverage (for example: if you do not interview at weekends, you will miss people who work during the week). You may also wish to interview an equal number of women and men, or a certain number of children. Do not make your sampling scheme too complex (for example: by trying to obtain a balance of sexes and range of ages, occupations and educational backgrounds). Such complex schemes are hard to implement as they require you to ask personal questions about potential respondents before trying to interview them.

Collecting 'Stories'

You may wish to use interviews to collect qualitative information on people's experiences rather than quantitative data. Your evaluation report with short 'stories' based on your interview notes. The advice provided above applies but you will also need to take account of the points below

Always:

- carefully structure the interview to ensure that all points are covered
- allow the interviewee time to describe their experiences in their own words
- take comprehensive notes
- write-up the interview immediately on completion while it is fresh in your mind.

Never:

- identify interviewees in your report unless they have agreed to be named and have agreed your text
- tape record an interview without the interviewee's permission.

Wherever possible you should copy your write-ups to the interviewees immediately after the interviews, and agree the final text with them. Sometimes, though, this will be impractical either because you do not know who the interviewee is or because the text may not show the interviewee in a good light (in which case the write-up should never explicitly or implicitly identify them).

Focus Groups

Debating

Focus Groups can be an exciting way to evaluate. They bring people together to debate the event, to reinforce their experiences and to identify improvements. You could bring very different groups together. For example:

- event organisers might visit a class of schoolchildren after an event and discuss it with them
- teachers from several schools might be brought together to discuss the impact of the event on schoolchildren and its relevance to the curriculum
- for larger events, all the presenters might be brought together to discuss experiences, organisation, methods of presentation and problems
- actors could hold a discussion and debate after a play.

The most successful focus groups are quite small, fewer than ten people. If you cannot avoid a larger group, you could consider using breakout groups (small groups who discuss issues separately and then report back to the entire group).

Successful Focus Groups

A successful focus group might work through the following steps

- **gaining commitment:** tell the participants why you are holding the discussion
- **setting the agenda:** identify the points you want to cover but remember to keep the debate flexible and free flowing
- **structuring debate:** it is often best if focus groups are facilitated by someone neutral; if this is impractical remember that the principal purpose of focus groups is to hear the views of the audience, not to present your own

- **drawing conclusions:** summarise the debate by drawing out conclusions where they emerge but always note diverse opinions and disagreement
- **writing up:** circulate your draft write-up to key participants and invite their comments if possible.

While this evaluation method can be very rewarding, it is quite poor at providing quantitative data rather than qualitative understandings.

Analysing the Results

Keep it Simple

Analysis need not be complex

Always:

- **Keep it simple.** Frequency counts, averages and totals will probably tell you most of what you want to know. You may also need to divide your data into groups, for example to compare the experiences of boys and girls.
- **Use familiar tools.** Analyse the data with tools you know how to use (for example: spreadsheets, statistical packages, calculators or pen and paper).

You will need to decide whether to use formal statistical analysis to identify significant trends in your data. For all but the largest and most carefully designed surveys, formal statistics will not be useful and may even be misleading.

Reporting the Results

Tell a Story

In nearly all instances, the evaluation will lead to a report (occasionally the only purpose for the evaluation will be to collect performance indicator data, for example on attendance and visitor satisfaction). The golden rule in writing evaluation reports is that your text should tell a story. Don't just summarise the answers to questionnaire or interview questions

Always:

- focus on major trends, successes and failures and drive home the key messages from the evaluation
- relegate detail to tables and annexes.

Never:

- use a table if a simple graph will do.

If you have the information, tell individual stories about people's experiences to provide interest or to highlight your key messages. And of course, keep it short and keep it simple!

The Report

Your report might be written under the following headings

- **Summary.** A one paragraph summary of the conclusions from the evaluation and the lessons learnt
- **The event.** A short description of the event itself.
- **The evaluation.** A paragraph on how you conducted the evaluation.
- **Results.** Description of the outcomes of the evaluation, including summary statistics and individual 'stories'.
- **Lessons learnt.** Summary of the main messages and lessons from the evaluation.
- **Annex.** If you have collected a lot of data, consign the full statistics to an annex using just the most important figures in the main text.

Identifying Trends

Do not emphasise small differences in your data. If you interview 100 people and 54 enjoyed your event, use "half enjoyed the event" rather than "slightly more than half enjoyed the event". Random factors will be responsible for all but major differences. Report all minor differences neutrally, saving your applause or criticism for large trends. When is a trend large? Formal statistics could help you determine this and larger evaluations should take this approach. A rule of thumb is more useful for small evaluations of public understanding of science events. Ask yourself: "is this statistic unexpected, disappointing or excellent news?" If the answer is "yes" focus on it. But if it is as expected only briefly report it.

Using the Results

If you do not use the results why conduct the evaluation? Use the evaluation to draw lessons for the future and to publicise your successes (or otherwise)

- if the news is good tell everyone
- if the news is bad, focus on the lessons and do not be unnecessarily harsh on yourself or your helpers - evaluation is a way of learning not a mechanism for condemning.

You should endeavour to build the lessons into the next event, circulate copies to your colleagues and publish summaries in newsletters. Remember, if you do not learn from it, why evaluate?

Conclusions

Evaluation is a very useful learning tool. But it is only a tool. The effort devoted to it needs to be the minimum required for the scale of event you are running and the importance of the potential evaluation outcomes to you. Three basic rules should underpin all evaluations of public understanding of science events

- keep it short
- keep it simple
- keep it to the point.

Helping Each Other

COPUS is trying to build a picture of best practice in public understanding of science that can be drawn upon by everyone. If you have evaluated an event COPUS would welcome knowledge of the results, good or bad. This will help COPUS respond to enquirers who want advice on running events and on what does or does not work. If you can help, please contact COPUS at 6 Carlton House Terrace, London SW1Y 5AG, email copus@royalsoc.ac.uk.

This leaflet was drafted by Andy Boddington and Trudy Coe, Evaluation Associates Ltd, 13 Castle Street, Buckingham, MK18 1BP, 01280 821751. Evaluation Associates evaluated the COPUS programme: copies of their report, published in 1995, are available from COPUS.